

Class **Amphibia** Gray, 1825^{1,2,3}

Amphibia incertae sedis

†**Albanerpetontidae** Fox & Naylor, 1982 (†4)^{4,5}

Order **Anura** Fischer von Waldheim, 1813 (frogs and toads) (410–466 genera; 6090 species; †~84)⁶

Family **Allophryinae** Goin, Goin, & Zug, 1978 (1 genus; 1 species)⁷

Family **Alsodidae** Mivart, 1869 (3 genera; 32 species)⁸

1. By D.C. Blackburn & D.B. Wake (for full contact details, see the list after **References**). The title of this contribution should be cited as “Class Amphibia Gray, 1825. In: Zhang, Z.-Q. (Ed.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness”.
2. The *Amphibian Species of the World* website (Frost, 2011), a continuation of Frost (1985), has guided our work; this site provides detailed information on the taxonomic history of the names we discuss here. Our decisions on which taxa to recognize and at what level are based on current literature and our assessment of current usage. Numbers of species used in our classification are based on the *AmphibiaWeb* website (www.amphibiaweb.org; Accessed 13 October 2011).
3. Linnaeus (1758) used Amphibia for a different assemblage of taxa than currently recognized, and authorship for the currently understood taxon is either de Blainville, 1816 (Dubois, 2004) or Gray, 1825. Frost *et al.* (2006) detail reasons for rejecting de Blainville as the authority. Phylogenetic analyses based on molecular data for extant taxa support the monophyly of a clade containing Anura, Caudata, and Gymnophiona (e.g., Zardoya & Meyer, 2001; San Mauro *et al.*, 2005). Phylogenetic analyses of morphological characters, including from a wide-range of extinct taxa, support this clade, with the extinct family Albanerpetontidae included in the crown group (e.g., Sigurdson & Green, 2011; Ruta *et al.*, 2003; Laurin & Reisz, 1997; Trueb & Cloutier, 1991b). However, some morphology-based analyses support non-monophyly of extant amphibians by placing the Gymnophiona more closely to extant amniotes (e.g., Anderson, 2008; Anderson *et al.*, 2008; but see Marjanović & Laurin, 2008, 2009) than to Anura and Caudata. Often the clade comprising extant amphibians has been referred to as Lissamphibia (Parsons & Williams, 1963; Romer, 1966; Duellman & Trueb, 1986; Bolt, 1991; Trueb & Cloutier, 1991a,b; see also Frost *et al.*, 2006), but we note that this view is not universally held (Dubois, 1983, 2004). We refer to the most exclusive clade containing crown-group amphibians as Class Amphibia, although we recognize that Amphibia is also often applied to extinct tetrapod taxa that are included neither within extant amniotes nor extant amphibians.
4. Throughout the manuscript the numbers of genera inclusive of extinct taxa, are listed, followed by the number of extinct (†) genera.
5. Historically, the †Albanerpetontidae has been allied to the extant orders of amphibians (Fox & Naylor, 1982; Milner, 2000; McGowan, 2002). Phylogenetic analyses have reaffirmed a close relationship between †Albanerpetontidae, comprising four extinct genera (for recent summary see Sweetman & Gardner, in press), and the extant orders Anura and Caudata, although the precise relationships remain uncertain (Anderson *et al.*, 2008; Ruta *et al.*, 2003).
6. Many extinct anuran generic-level taxa exist, but most cannot be assigned with confidence to the families recognized here. A few are demonstrably outside of crown-group Anura (e.g., †*Czatkobatrachus*, †*Mesophryne*, †*Notobatrachus*, †*Prosalirus*, †*Triadobatrachus*, †*Vieraella*, †*Yizhoubatrachus*; Báez & Basso, 1996; Gao & Wang, 1998; Gao & Chen, 2004). When phylogenetic analyses or other evidence allow placement of an extinct genus with some confidence within the crown-group of a family of living species, we have opted to include that extinct taxon within that family. However, because of either a lack of thorough analyses or changing concepts of families, we cannot place many of these extinct taxa within currently recognized families. These extinct taxa include †*Altanulia*, †*Aralobatrachus*, †*Arariphrynus*, †*Avitabatrachus*, †*Aygroua*, †*Comobatrachus*, †*Cordicephalus*, †*Cratia*, †*Elkobatrachus*, †*Eobatrachus*, †*Eopelobates*, †*Eophractus*, †*Eorubeta*, †*Estesiella*, †*Estesina*, †*Estesius*, †*Eurycephalella*, †*Hatzegobatrachus*, †*Itemirella*, †*Kizylkuma*, †*Latonia*, †*Liaobatrachus*, †*Lithobatrachus*, †*Liventsovskia*, †*Lutetiobatrachus*, †*Macropelobates*, †*Messelobatrachus*, †*Neoprocoela*, †*Neusibatrachus*, †*Nezpercius*, †*Opisthocoeillus*, †*Palaeophrynos*, †*Paralaton*, †*Pelophilus*, †*Pliobatrachus*, †*Proceratobatrachus*, †*Ranomorphus*, †*Ranavus*, †*Soevesoederberghia*, †*Sunnybatrachus*, †*Thaumastosauros*, †*Theatoni*, †*Thoraciliacus*, and †*Uldzinia*; see Sanchiz (1998) for a review of most extinct anuran taxa.
7. Frost *et al.* (2006), avoiding families with only one genus, treated Allophryinae and Centroleninae as subfamilies of Centrolenidae. Phylogenetic analyses support a sister relationship between these clades (Austin *et al.*, 2002; Faivovich *et al.*, 2005; Wiens *et al.*, 2005; Frost *et al.*, 2006; Guayasamin *et al.*, 2008), but the revision by Guayasamin *et al.* (2009) maintained Allophryinae and Centrolenidae as separate families. We see either as acceptable and viable taxonomies.
8. Pyron & Wiens (2011) were unable to obtain a robust topology of several genera once considered leptodactylids (see also Correa *et al.*, 2006; Frost *et al.*, 2006; Grant *et al.*, 2006) and recognized eight small families: Alsodidae, Batrachylidae, Ceratophryidae, Cycloramphidae, Hylodidae, Odontophryinae, Rhinodermatidae, and Telmatobiidae. Previously, Grant *et al.* (2006) refined the taxonomy of Frost *et al.* (2006) by recognizing Hylodidae as distinct from the Cycloramphidae. Correa *et al.* (2006) resolved different relationships among these taxa, but used less comprehensive sampling. Both Nuin and do Val (2005) and Heinicke *et al.* (2009), with limited taxon sampling, showed that Cycloramphidae was likely not monophyletic. Frost *et al.* (2006) showed that *Rhinoderma* is nested within their Cycloramphidae; this was also suggested by Correa *et al.* (2006) who found *Rhinoderma* to be the sister taxon of *Insuetophrynos*. Relationships among some of these genera based on morphological data were discussed by Diaz & Valencia (1985), who included *Caudiverbera* (now *Calpytocephalella*) in this lineage, and Diaz (1989), with further details on potentially useful diagnostic features within this group provided by Alcalde & Blotto (2006), Cárdenas-Rojas *et al.* (2007), and Rabanal & Formas (2009). Grant *et al.* (2006) extended the taxonomy of Frost *et al.* (2006) by recognizing three subfamilies of Ceratophryidae. However, while several phylogenetic studies have suggested that these subfamilies form a clade (Faivovich *et al.*, 2005; Frost *et al.*, 2006; Grant *et al.*, 2006), others have not (Darst & Cannatella, 2004; Wiens, 2005; Correa *et al.*, 2006; Roelants *et al.*, 2007; Heinicke *et al.*, 2009; Pyron & Wiens, 2011; see also Ruane *et al.*, 2011). Other studies are consistent with monophyly but did not include taxa from all three subfamilies (Wiens *et al.*, 2005). While reporting monophyly, Frost *et al.* (2006) and Grant *et al.* (2006) differed in assessments of relationships among the subfamilies: Grant *et al.* (2006) found a sister relationship between Telmatobiinae and Ceratophryinae whereas Frost *et al.* (2006) reported a sister relationship between Batrachylinae and Ceratophryinae. Roelants *et al.* (2007) did not resolve Ceratophryidae as monophyletic, but reported a sister relationship between taxa in the Batrachylinae and Telmatobiinae. Heinicke *et al.* (2009) also did not resolve Ceratophryidae as monophyletic, but instead found a sister relationship between taxa in the Telmatobiinae and Ceratophryinae. Bossuyt & Roelants (2009) recognized two families, Telmatobiidae and Ceratophryidae, yet did not specify the content of these families, which is crucial given the uncertainty in relationships among the subfamilies. Given that Pyron & Wiens (2011) is the analysis to date with the most complete taxonomic sampling of taxa previously placed in the Ceratophryidae, Cycloramphidae, and Hylodidae, we follow their elevation to family level of the three subfamilies of Ceratophryidae of Grant *et al.* (2006). Córdova & Descailleux (2005) provide a cladistic analysis of karyotypic data suggesting that *Telmatobius* is paraphyletic with respect to *Batrachophrynos*. For the families Alsodidae and Batrachylidae, we follow the genus-level revision of Pyron & Wiens (2011) that resulted in placing *Hylorhina* and several *Batrachyla* species in *Eupsophus*.

Family **Alytidae** Fitzinger, 1843 (2 genera; 12 species; †6)⁹
 Subfamily **Alytinae** Fitzinger, 1843 (1 genus; 5 species)
 Subfamily **Discoglossinae** Günther, 1858 (1 genus; 7 species)
 Family **Aromobatidae** Grant, Frost, Caldwell, Gagliardo, Haddad, Kok, Means, Noonan, Schargel & Wheeler, 2006 (5 genera; 103 species)¹⁰
 Family **Arthroleptidae** Mivart, 1869 (8 genera; 144 species)¹¹
 Family **Ascaphidae** Fejérváry, 1923 (1 genus; 2 species)¹²
 Family **Batrachylidae** Gallardo, 1965 (2 genera; 11 species)¹³
 Family **Bombinatoridae** Gray, 1825 (2 genera; 10 species; †1)¹⁴
 Family **Brachycephalidae** Günther, 1858 (2 genera; 49 species)¹⁵
 Family **Brevicipitidae** Bonaparte, 1850 (5 genera; 32 species)¹⁶
 Family **Bufonidae** Gray, 1825 (~10–~48 genera; 568 species)¹⁷
 Family **Calyptocephalellidae** Reig, 1960 (2 genera; 4 species)¹⁸
 Family **Centrolenidae** Taylor, 1951 (12 genera; 150 species)¹⁹
 Subfamily **Centroleninae** Taylor, 1951 (10 genera; 118 species)
 Subfamily **Hyalinobatrachinae** Guayasamin, Castroviejo-Fisher, Trueb, Ayarzagüena, Rada, & Vilà, 2009 (2 genera; 32 species)

9. Analyses of molecular data support a clade containing *Alytes*, *Barbourula*, *Bombina*, and *Discoglossus* (Hay *et al.*, 1995; Hoegg *et al.*, 2004; San Mauro *et al.*, 2004a, 2005; Roelants & Bossuyt, 2005; Frost *et al.*, 2006; Gissi *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Blackburn *et al.*, 2010). *Alytes* and *Discoglossus* have long been recognized as closely related from morphology-based phylogenetic analyses (e.g., Cannatella, 1985; Gao & Wang, 2001) and molecular phylogenetic analyses agree. Historically, the taxon containing these genera has been referred to as Discoglossidae. Sanchiz (1998) and Dubois (2005) noted the nomenclatural priority of Alytidae. Bossuyt & Roelants (2009) recognize Alytidae and Discoglossidae as separate families based on the extent of “evolutionary time” separating these clades, and this remains an appropriate alternative taxonomy, as would an alternative more inclusive family containing *Barbourula* and *Bombina* (and thus the Bombinatoridae, see below). We tentatively include six extinct taxa in the Alytidae (†*Callobatrachus*, †*Enneabatrachus*, †*Eodiscoglossus*, †*Prodiscoglossus*, †*Scotiophryne*, †*Wealdenbatrachus*, †*Zaphrissa*), although their phylogenetic relationships remain unclear (Sanchiz, 1998; Gao & Wang, 2001; Gao & Chen, 2004; Marjanović & Laurin, 2007).
10. Grant *et al.* (2006) separated a family Aromobatidae (with three subfamilies: Allobatinae, Anomaloglossinae, Aromobatinae) from the Dendrobatidae. While some have rejected this partitioning (Santos *et al.*, 2009; Santos & Cannatella, 2011; Pyron & Wiens, 2011), many in the research community (e.g., Verdade & Rodrigues, 2007; Manzanilla *et al.*, 2009; Brown & Twomey, 2009) have found this partitioning useful and follow the taxonomy of Grant *et al.* (2006). We view either family-level taxonomy as a viable taxonomy. A supplementary document associated with Santos *et al.* (2009) disputes the higher-level taxonomy of Grant *et al.* (2006), but monophyly of the Dendrobatidae and Aromobatidae and the proposed subfamilies of Dendrobatidae receive strong support. The basic topology of generic relationships within Aromobatidae recovered by Santos *et al.* (2009), as well as by Pyron & Wiens (2011), differs little from that of Grant *et al.* (2006). Santos *et al.* (2009) find no support for the Anomaloglossinae. One composite taxon, which combined molecular data for *Allobates alagoanus* with morphological data from *A. olfersioides*, was resolved as sister to the remaining species of *Allobates* by Grant *et al.* (2006). Verdade & Rodrigues (2007) synonymized these two species, with *A. olfersioides* having priority. Santos *et al.* (2009) found this species (referred to in Supplementary Materials as *Colostethus alagoanus*) to be the sister-taxon of all other species of Aromobatidae. This result renders *Allobates*, and thus Allobatinae, paraphyletic. Pending further analysis of intrafamilial relationships, we list no subfamilies for the Aromobatidae. Grant *et al.* (2006) and Santos *et al.* (2009) provide conflicting views on the number of genera recognized and allocated to the Aromobatidae and Dendrobatidae (see also Brown *et al.*, 2011).
11. The Arthroleptidae (sensu Frost *et al.*, 2006) has been recognized as a morphologically distinctive lineage for decades (Laurent 1941, 1942, 1951; see also Dubois, 1981). This includes recognition that *Leptopelis* may be more closely related to genera in the Arthroleptidae than to those in the Hyperoliidae, a hypothesis supported by a variety of molecular phylogenetic studies (Emerson *et al.*, 2000; Biju & Bossuyt, 2003; Vences *et al.*, 2003b; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Roelants *et al.*, 2007). Frost *et al.* (2006) recognized two subfamilies: Leptopelinae (*Leptopelis*) and Arthroleptinae (*Arthroleptis*, *Astylosternus*, *Cardioglossa*, *Leptodactylodon*, *Nyctibates*, *Scotolepis*, and *Trichobatrachus*). However, uncertainty remains in the placement of *Leptopelis*, including the possibility that the Arthroleptinae sensu Frost *et al.* (2006) is paraphyletic with respect to *Leptopelis* (Vences *et al.*, 2003b; Scott, 2005; Frost *et al.*, 2006; Blackburn, 2008), and thus we do not recognize subfamilies of Arthroleptidae.
12. Frost *et al.* (2006) recognized Ascaphidae and Leiopelmatidae as subfamilies of Leiopelmatidae. Morphology-based hypotheses of phylogeny have either separated these two families as successively branching lineages at the base of anuran phylogeny (e.g., Cannatella, 1985) or resolved them as sister taxa (e.g., Báez & Basso, 1996; Wang *et al.*, 2001). Green *et al.* (1989) found these taxa to be genetically divergent and suggested that *Ascaphus* could be more closely related to other clades of extant anurans than to *Leiopelma*, though recent molecular phylogenetic analyses have recognized these as sister taxa (e.g., Frost *et al.*, 2006; Roelants *et al.*, 2007; Irisarri *et al.*, 2010; Pyron & Wiens, 2011). Bossuyt & Roelants (2009) maintained two families because of the degree of genetic divergence, as did Pyron & Wiens (2011).
13. See footnote 8.
14. Monophyly of Bombinatoridae is supported by both molecular (Blackburn *et al.*, 2010) and morphology-based (Cannatella, 1985; Gao & Wang, 2001) phylogenetic studies. We include †*Paradiscoglossus* in the Bombinatoridae (Estes & Sanchiz, 1982). See also footnote 9.
15. Hedges *et al.* (2008) restricted Brachycephalidae to *Brachycephalus* and *Ischnocnema*. Brachycephalidae is one of four recognized families in the unranked taxon Terrarana (Hedges *et al.*, 2008; Heinicke *et al.*, 2009). A viable alternative taxonomy that avoids reliance on unranked taxa would be to recognize the families of Terrarana as subfamilies of Brachycephalidae.
16. Brevicipitidae (sensu Frost *et al.*, 2006), long included in Microhylidae, is now recognized as a member of a larger clade endemic to sub-Saharan Africa (e.g., van der Meijden *et al.*, 2004; Frost *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Kurabayashi *et al.*, 2011). Dubois (2005) enlarged the Brevicipitidae to also contain the taxa recognized here as Arthroleptidae, Hemisotidae, and Hyperoliidae, which is a viable alternative taxonomic arrangement that would produce a taxon with nearly 400 species.

Family **Ceratobatrachidae** Boulenger, 1884 (5 genera; ~86 species)²⁰
 Family **Ceratophryidae** Tschudi, 1838 (3 genera; 12 species; †3)²¹
 Family **Ceuthomantidae** Heinicke, Duellman, Trueb, Means, MacCulloch & Hedges, 2009 (1 genus; 4 species)²²
 Family **Conrauidae** Dubois, 1992 (1 genus; 6 species)²³
 Family **Craugastoridae** Hedges, Duellman, & Heinicke, 2008 (2 genera; 115 species)²⁴
 Family **Cycloramphidae** Bonaparte, 1850 (2 genera; 33 species)²⁵
 Family **Dendrobatidae** Cope, 1865 (13 genera; 182 species)²⁶
 Subfamily **Colostethinae** Cope, 1867 (4 genera; 64 species)
 Subfamily **Dendrobatinae** Cope, 1865 (8 genera; 59 species)

17. Generic-level taxonomy within Bufonidae is in a state of flux (Frost *et al.*, 2006, 2009; Pauly *et al.*, 2009). Controversy arises because the many species historically referred to *Bufo* do not form an exclusive clade with respect to morphologically distinct satellite taxa (e.g., *Ansonia*, *Capensibufo*, *Nectophrynoides*, *Pedostibes*, *Schismaderma*, *Stephopaedes*). In the interests of taxonomic stability, some workers prefer to maintain *Bufo* for readily recognized “toad”-like taxa, even to the point of reducing morphologically divergent taxa long recognized as genera to subgenera. This would result in a very large genus *Bufo*, with more than 450 species. Alternatively, approximately 50 genera would be recognized (Frost *et al.*, 2006; Frost, 2011), with many species long placed in *Bufo* and having extensive literature references being placed in newly (or recently) created genera. Many of the generic-level taxonomic changes have been embraced already by much of the community of amphibian taxonomists (Pramuk *et al.*, 2007; Van Bocxlaer *et al.*, 2009, 2010; Maciel *et al.*, 2010). Pyron & Wiens (2011) recognize 35 genera.
18. Calyptocephalellidae is recovered as monophyletic and a sister taxon of our Myobatrachidae (San Mauro *et al.*, 2005; Wiens *et al.*, 2005; Correa *et al.*, 2006; Frost *et al.*, 2006; Pyron & Wiens, 2011). Frost *et al.* (2006) referred to the clade containing *Calyptocephalella* and *Telmatobufo* as the Batrachophrynidae because it was not yet clear that *Batrachophrynus* is likely embedded within the genus *Telmatobius* (Aguilar & Pacheco, 2005; Córdova & Descailleux, 2005; Aguilar & Valencia, 2009).
19. Guayasamin *et al.* (2009) recognized two subfamilies within the Centrolenidae. We follow Pyron & Wiens (2011) in placing the monotypic *Ikakogi* in the Centroleninae. See also footnote 7.
20. Multiple phylogenetic studies have revealed complicated relationships among clades variously assigned to the Ranidae (see Dubois, 1981, 1983, 1992, 2005; Duellman & Trueb, 1986), including clades recognized here as the Arthroleptidae, Mantellidae, and Rhacophoridae (Emerson *et al.*, 2000; Vences *et al.*, 2003bc; Roelants *et al.*, 2004, 2007; Scott, 2005; van der Meijden *et al.*, 2005; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Wiens, 2007; Wiens *et al.*, 2009; Pyron & Wiens, 2011; see also Ford, 1990; Ruvinsky & Maxson, 1996; Biju & Bossuyt, 2003; Haas, 2003). Dubois (2005) suggested recognizing fourteen subfamilies of Ranidae (Ceratobatrachinae, Conrauiinae, Dicroglossinae, Lankanectinae, Mantellinae, Micrixalinae, Nyctibatrachinae, Petropedetinae, Phrynobatrachinae, Ptychadeninae, Pyxicephalinae, Raninae, Ranixalinae, and Rhacophorinae); for a summary of the taxonomic history of “ranid” frogs, see Frost *et al.* (2006). The subfamilial taxa of Dubois (2005) were elevated to the family level by Frost *et al.* (2006), although several were combined into single families; Lankanectinae and Nyctibatrachinae were combined into the Nyctibatrachidae, and Conrauiinae, Petropedetinae, and Ranixalinae were combined into the Petropedetidae (although Ranixalidae is recognized as a separate family by subsequent authors; Van Bocxlaer *et al.*, 2006; Bossuyt & Roelants, 2009; Wiens *et al.*, 2009). Some authors (Bossuyt *et al.*, 2006; Wiens *et al.*, 2009) follow the concept of Ranidae advocated by Dubois (2005), but there is growing use of the family-level taxonomy advocated by Frost *et al.* (2006). As pointed out by Frost *et al.* (2006), their unranked taxon Natatanura roughly corresponds to what previous workers have referred to as “ranids”. There is high support for the Natatanura of Frost *et al.* (2006) from a variety of phylogenetic studies, although the relationships among these families remain unresolved (Vences *et al.*, 2003bc; Roelants *et al.*, 2004, 2007; Scott, 2005; Bossuyt *et al.*, 2006; Wiens, 2007; Wiens *et al.*, 2009; Pyron & Wiens, 2011). Ceratobatrachidae is supported as monophyletic (Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens *et al.*, 2009; Ruane *et al.*, 2011; Pyron & Wiens, 2011; see also Brown, 2004).
21. Based on recent phylogenetic studies (Evans *et al.*, 2008; Ruane *et al.*, 2011), we include three extinct genera in the Ceratophryidae (†*Baurubatrachus*, †*Beelzebudo*, †*Wawelia*). See also footnote 8.
22. Heinicke *et al.* (2009) described the Ceuthomantidae, as well as its sole genus *Ceuthomantis*, and showed that it is sister to a clade containing other families placed in the unranked taxon Terrarana.
23. The monophyly of a clade containing *Conraua* and *Petropedetes* (including taxa formerly placed in *Arthroleptides*) is supported in several phylogenetic analyses (Bossuyt *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens *et al.*, 2009; Ruane *et al.*, 2011), but not others (van der Meijden *et al.*, 2005; Zimkus *et al.*, 2010; Pyron & Wiens, 2011). Frost *et al.* (2006) resolved this clade to also contain the taxon here recognized as Ranixalinae, but this is not supported by subsequent analyses. Dubois (1992) considered the Conrauiini to be a tribe within his subfamily Dicroglossinae, Ranidae of Dubois, 1992) and, by implication, included *Petropedetes* within the Phrynobatrachidae; Dubois (2005) later treated both Conrauiinae and Petropedetinae as subfamilies of the Ranidae (sensu Dubois, 2005). In light of the uncertain sister relationship between these two clades and their likely deep divergence (Roelants *et al.*, 2007), we recognize these as two distinct families, Conrauidae and Petropedetidae. For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.
24. Hedges *et al.* (2008) proposed the Craugastoridae for the diverse *Craugastor* and its sister taxon, a new genus *Haddadus*. The Craugastoridae is one of four families in the unranked taxon Terrarana (Hedges *et al.*, 2008; Heinicke *et al.*, 2009; Padial *et al.*, 2009). Pyron & Wiens (2011) found Craugastoridae sensu Hedges *et al.* (2009) to be embedded within the Strabomantidae sensu Hedges *et al.* (2009), and expanded the Craugastoridae to include all taxa previously assigned to Strabomantidae. However, because of low support values among basal nodes in this larger clade, the analysis of Pyron & Wiens (2011) does not reject the hypothesis that Craugastoridae is sister to the Strabomantidae. Higher-level relationships among these clades require further study.
25. See footnote 8.
26. Grant *et al.* (2006) recognize three subfamilies of Dendrobatidae (for discussion regarding taxa in the Aromobatidae, see footnote 10). The phylogenetic relationships resolved in other studies (Vences *et al.*, 2000, 2003a; Roberts *et al.*, 2006; Santos *et al.*, 2009; Santos & Cannatella, 2011) support the tree topology on which the subfamily taxonomy of Grant *et al.* (2006) is based. Santos *et al.* (2009; see also Santos & Cannatella, 2011) argued that the partitioning of *Dendrobates* into six genera was unnecessary (*Adelphobates*, *Dendrobates*, *Excidobates*, *Minyobates*, *Oophaga*, *Ranitomeya*). Brown *et al.* (2011) discuss this matter at length and elect to recognize all six genera and describe a seventh genus, *Andinobates*.

Subfamily **Hyloxalinae** Grant, Frost, Caldwell, Gagliardo, Haddad, Kok, Means, Noonan, Schargel & Wheeler, 2006 (1 genus; 59 species)

Family **Dicroglossidae** Anderson, 1871 (12–14 genera; 177 species)²⁷

Subfamily **Dicroglossinae** Anderson, 1871 (10–12 genera; 155 species)

Subfamily **Occidozyginae** Fei, Ye, & Huang, 1990 (2 genera; 22 species)

Family **Eleutherodactylidae** Lutz, 1954 (4 genera; 202 species)²⁸

Subfamily **Eleutherodactylinae** Lutz, 1954 (2 genera; 195 species)

Subfamily **Phyzelaphryinae** Hedges, Duellman, & Heinicke, 2008 (2 genera; 7 species)

Family †**Gobiatiidae** Roček & Nesov, 1993 (†3)²⁹

Family **Heleophrynidae** Noble, 1931 (2 genera; 6–7 species)³⁰

Family **Hemiphractidae** Peters, 1862 (6 genera; 95 species)³¹

Family **Hemisotidae** Cope, 1867 (1 genus; 9 species)³²

Family **Hylidae** Rafinesque, 1815 (42–46 genera; 904 species; †1)³³

Subfamily **Hylinae** Rafinesque, 1815 (36–39 genera 647 species;)

Subfamily **Pelodryadinae** Günther, 1858 (1–2 genera; 198 species)

Subfamily **Phyllomedusinae** Günther, 1858 (5 genera; 59 species)

Family **Hylodidae** Günther, 1858 (3 genera; 42 species)³⁴

Family **Hyperoliidae** Laurent, 1943 (18 genera; 214 species)³⁵

Family **Leiopelmatidae** Mivart, 1869 (1 genus; 4 species)³⁶

Family **Leiuperidae** Bonaparte, 1850 (7 genera; 85 species)³⁷

Family **Leptodactylidae** Werner, 1896 (6 genera; 105 species)³⁸

27. Phylogenetic analyses of molecular data support monophyly of the Dicroglossidae (Kosuch *et al.*, 2001; Roelants *et al.*, 2004, 2007; Kurabayashi *et al.*, 2005; van der Meijden *et al.*, 2005; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Che *et al.*, 2007; Wiens, 2007; Wiens *et al.*, 2009; Ruane *et al.*, 2011). Two clades, the subfamilies Dicroglossinae and Occidozyginae, also receive strong support (Kosuch *et al.*, 2001; Roelants *et al.*, 2004; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Che *et al.*, 2007; Wiens *et al.*, 2009; Ruane *et al.*, 2011; Pyron & Wiens, 2011). Generic-level taxonomy and phylogenetic relationships within the Dicroglossinae remain unresolved (Dubois *et al.*, 2001; Jiang *et al.*, 2005; Che *et al.*, 2007, 2009, 2010; Pyron & Wiens, 2011). For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.
28. Hedges *et al.* (2008) recognized two well-supported clades within the Eleutherodactylidae, one including *Diasporus* and the mega-diverse genus *Eleutherodactylus* and the other including the species-poor *Adelophryne* and the monotypic *Phyzelaphryne*.
29. The †Gobiatiidae is an extinct family of three genera (†*Cretasalia*, †*Gobiates*, and †*Gobiatoidea*) with obscure relationships to other families of Anura (Roček, 2008). Sanchiz (1998) questioned the validity of †*Gobiatoidea*.
30. Molecular phylogenies have resolved the Heleophrynidae as the sister taxon of all other Neobatrachia (e.g., Hoegg *et al.*, 2004; Frost *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007). Van Dijk (2008) erected *Hadromophryne*, the validity of which is further supported by Pyron & Wiens (2011).
31. Monophyly of the Hemiphractidae has been controversial. Based on molecular phylogenetic analyses, some authors have found the Hemiphractidae to be paraphyletic (Darst & Cannatella, 2004), or polyphyletic (Faivovich *et al.*, 2005; Frost *et al.*, 2006), whereas others resolved it to be monophyletic (Wiens, 2007; Guayasamin *et al.*, 2008; Heinicke *et al.*, 2009; Pyron & Wiens, 2011). Frost *et al.* (2006) recognized three families (Amphignathodontidae, Cryptobatrachidae, Hemiphractidae). Because more recent studies have resolved this family as monophyletic, we maintain the Hemiphractidae for *Cryptobatrachus*, *Flectonotus*, *Gastrotheca*, *Hemiphractus*, and *Stefania*, as well as the resurrected *Fritziana* (Duellman *et al.*, 2011).
32. The family Hemisotidae, containing only the genus *Hemisus*, is assumed to be monophyletic, though we know of no explicit test. Hemisotidae is the sister taxon of the Brevicipitidae (Frost *et al.*, 2006; Roelants *et al.*, 2007; van der Meijden *et al.*, 2007b; Wiens, 2007), a relationship previously suggested by morphological phylogenetic studies (Blommers-Schlösser, 1993; Channing, 1995). One viable alternative taxonomic arrangement would be to include Hemisotidae as a subfamily of the Brevicipitidae.
33. The content of the Hylidae has been extensively modified in recent years. Those frogs recognized above as the Hemiphractidae were previously considered part of the Hylidae (Duellman, 1970), but they are not necessarily closely related (Darst & Cannatella, 2004; Frost *et al.*, 2006; Wiens, 2007; Heinicke *et al.*, 2009). Most analyses agree in resolving a monophyletic lineage containing three subfamilies (Darst & Cannatella, 2004; Faivovich *et al.*, 2005; Wiens *et al.*, 2005; Frost *et al.*, 2006; Pyron & Wiens, 2011), two of which (Pelodryadinae and Phyllomedusinae) form a clade sister to the third (Hylinae). However, there is some disagreement on the monophyly of Hylidae (Roelants *et al.*, 2007), which, combined with deep genetic divergences, has led some authors to recognize each subfamily as a distinct family (Bossuyt & Roelants, 2009). We recognize a single family with three subfamilies. Faivovich *et al.* (2005) extensively revised the generic-level taxonomy of Hylinae. Generic-level taxonomy of the Pelodryadinae remains in flux with authors recognizing one or two genera (Faivovich *et al.*, 2005; Frost *et al.*, 2006; Rosauer *et al.*, 2009; Tyler *et al.*, 2009; Pyron & Wiens, 2011). For the Phyllomedusinae, Faivovich *et al.* (2010) synonymized *Hylomantis* and *Pachymedusa* with *Agalychnis*. The relationships of †*Australobatrachus* to currently recognized clades remains unclear.
34. The three genera of Hylodidae form a clade (Nuin & do Val, 2005; Frost *et al.*, 2006; Grant *et al.*, 2006; see also Pyron & Wiens, 2011) that Grant *et al.* (2006) resolved as the sister taxon of the Dendrobatidae + Aromobatidae (also suggested by morphological and karyological data; e.g., Lynch, 1971; Bogart, 1991; Augier *et al.*, 2004) and thus removed it from the Cyclorhamphidae, where it had been placed by Frost *et al.* (2006). Pyron & Wiens (2011) resolved Hylodidae as the sister taxon of Alsodidae, and not near the Dendrobatidae + Aromobatidae.
35. The Hyperoliidae is a diverse clade of eighteen genera, many of which have long been recognized as sharing morphological features (Laurent 1986; Drewes, 1984) and both morphological (Drewes, 1984) and molecular phylogenetic analyses support monophyly (Vences *et al.*, 2003b; Frost *et al.*, 2006; Veith *et al.*, 2009). As detailed in footnote 11, the genus *Leptopelis* is now considered part of the Arthroleptidae, which is the sister taxon to Hyperoliidae.
36. See footnote 12.

Family **Mantellidae** Laurent, 1946 (12 genera; 198 species)³⁹
 Subfamily **Boophinae** Vences & Glaw, 2001 (1 genus; 72 species)
 Subfamily **Laliostominae** Vences & Glaw, 2001 (2 genera; 4 species)
 Subfamily **Mantellinae** Laurent, 1946 (9 genera; 122 species)
 Family **Megophryidae** Bonaparte, 1850 (10 genera; 160 species)⁴⁰
 Family **Micrixilidae** Dubois, Ohler, & Biju, 2001 (1 genus; 11 species)⁴¹
 Family **Microhylidae** Günther, 1858 (68 genera; 495 species)⁴²
 Subfamily **Asterophryinae** Günther, 1858 (22 genera; 252 species)
 Subfamily **Cophylinae** Cope, 1889 (7 genera; 58 species)
 Subfamily **Dyscophinae** Boulenger, 1882 (1 genus; 3 species)
 Subfamily **Gastrophryninae** Fitzinger, 1843 (13 genera; 59 species)
 Subfamily **Hoplophryninae** Noble, 1931 (2 genera; 3 species)
 Subfamily **Kalophryninae** Mivart, 1869 (1 genus; 17 species)
 Subfamily **Melanobatrachinae** Noble, 1931 (1 genus; 1 species)
 Subfamily **Microhylinae** Günther, 1858 (9 genera; 71 species)
 Subfamily **Otophryninae** Wassersug & Pyburn, 1987 (2 genera; 6 species)
 Subfamily **Phrynomerinae** Noble, 1931 (1 genus; 5 species)
 Subfamily **Scaphiophryninae** Laurent, 1946 (2 genera; 12 species)
 Family **Myobatrachidae** Schlegel, 1850 (20 genera; 127 species; †1)⁴³
 Subfamily **Limnodystinae** Lynch, 1969 (8 genera; 44 species)
 Subfamily **Myobatrachinae** Schlegel, 1850 (12 genera; 83 species; †1)
 Family **Nasikabatrachidae** Biju & Bossuyt, 2003 (1 genus; 1 species)⁴⁴
 Family **Nyctibatrachidae** Blommers-Schlösser, 1993 (2 genera; 29 species)⁴⁵
 Family **Odontophrynidae** Lynch, 1969 (3 genera; 36 species)⁴⁶
 Family †**Palaeobatrachidae** Špinar, 1972 (†4)⁴⁷

37. Grant *et al.* (2006) recognized Leiuperidae for a clade of seven genera that Frost *et al.* (2006) included within the Leptodactylidae. Frost *et al.* (2006) did not resolve the Leiuperidae as monophyletic but both Correa *et al.* (2006) and Grant *et al.* (2006) did. Leiuperidae is treated as a subfamily of Leptodactylidae by Pyron & Wiens (2011).
38. Ruvinsky & Maxson (1996) showed that Leptodactylidae sensu Lynch (1971, 1973) is polyphyletic (see also Darst & Cannatella (2004), Faivovich *et al.* (2005), Wiens *et al.* (2005), and Carrera *et al.* (2006). Frost *et al.* (2006) partitioned Leptodactylidae into multiple families; Grant *et al.* (2006) modified this scheme by further partitioning (see also Pyron & Wiens, 2011). Based in part on previous work of Heyer (1998) and Kokobum & Giaretta (2005) and finding that *Adenomera* and *Lithodytes* form a clade sister to *Leptodactylus*, Frost *et al.* (2006) considered these genera to be synonyms of *Leptodactylus*. However, subsequent authors have provided evidence that these genera are morphologically distinct (Ponssa & Heyer, 2007), and both molecular (Pyron & Wiens, 2011) and morphology-based (de Sá *et al.*, 2005; Ponssa *et al.*, 2010) phylogenetic analyses suggest that *Adenomera* and *Lithodytes* are not nested within *Leptodactylus*.
39. Phylogenetic analyses provide strong support for the monophyly of the Mantellidae (Emerson *et al.*, 2000; Vences *et al.*, 2003bc; Roelants *et al.*, 2004, 2007; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Vieites *et al.*, 2009; Wiens *et al.*, 2009; Ruane *et al.*, 2011). The subfamilies (Boophinae, Laliostominae, and Mantellinae) are also strongly supported (Vences *et al.*, 2003c; Roelants *et al.*, 2004, 2006; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Glaw *et al.*, 2006; Kurabayashi *et al.*, 2008; Vieites *et al.*, 2009; Wiens *et al.*, 2009; Pyron & Wiens, 2011). Frost *et al.* (2006) included the Laliostominae in the Mantellinae, but the taxonomic community has not accepted this proposal (e.g., Glaw & Vences, 2006; Glaw *et al.*, 2006; Hiobariyanto *et al.*, 2010) and these clades may not be sister to one another (Pyron & Wiens, 2011). The relationship of the monotypic *Tsingymantis* to the recognized subfamilies remains a point for future research (Glaw *et al.*, 2006; Kurabayashi *et al.*, 2008). For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.
40. The monophyly of the Megophryidae is widely accepted (e.g., Ford & Cannatella, 1993; Frost *et al.*, 2006). The most significant recent taxonomic change is the recognition that *Leptobrachium* is paraphyletic with respect to *Vibrissaphora* (Rao & Wilkinson, 2008; Brown *et al.*, 2009). We refrain from recognizing subfamilies within Megophryidae (Leptobrachinae, Leptolalaginae, Megophryinae, as advocated by Delorme *et al.*, 2006) until phylogenetic analyses with more inclusive taxon sampling are available. However, the molecular phylogenetic analysis by Pyron & Wiens (2011) generally supports the subfamilies of Delorme *et al.* (2006), but lacks sampling for *Leptobatrachella*; their analysis also suggests that *Xenophrys* may be paraphyletic with respect to both *Megophrys* and *Brachytarsophrys*.
41. The monophyly of the Micrixalidae, containing only the genus *Micrixalus*, is supported by phylogenetic analyses (Bossuyt *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Frost *et al.*, 2006; Wiens *et al.*, 2009; see also Dubois *et al.*, 2001). For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.
42. Following recognition of the Brevicipitidae (see footnote 16), there is strong support for the monophyly of the Microhylidae (Ford & Cannatella, 1993; Haas, 2003; van der Meijden *et al.*, 2004, 2007b; Frost *et al.*, 2006; Roelants *et al.*, 2007; Kurabayashi *et al.*, 2011). Based in part on the substantial divergences between subfamilies observed in DNA sequence data, Bossuyt & Roelants (2009) elevated each subfamily to family rank. However, Bossuyt & Roelants (2009) did not mention the Otophryninae, leaving its status uncertain, and failed to provide any details on the many taxa not assigned to subfamilies within the classification scheme of Frost *et al.* (2006). At this point, adopting a strategy in which each subfamily of Microhylidae is elevated to family would lead to many genera of unclear affinities being orphaned. Thus, we advocate recognizing the family Microhylidae with multiple subfamilies and leaving certain genera without subfamily designation. Based on Greenbaum (2006), we suggest that *Altigius*, *Melanophryne*, *Myersiella*, and *Syncope* should be included in the Gastrophryninae. Following Pyron & Wiens (2011) and Trueb *et al.* (2011), we tentatively include *Synapturanus* in the Otophryninae.

Family **Pelobatidae** Bonaparte, 1850 (1 genus; 4 species)⁴⁸
 Family **Pelodytidae** Bonaparte, 1850 (1 genus; 3 species; †2)⁴⁹
 Family **Petropedetidae** Noble, 1931 (1 genus; 12 species)⁵⁰
 Family **Phrynobatrachidae** Laurent, 1941 (1 genus; 84 species)⁵¹
 Family **Pipidae** Gray, 1825 (4–5 genera; 33 species; †7)⁵²
 Family **Ptychadenidae** Dubois, 1987 (3 genera; 51 species)⁵³
 Family **Pyxicephalidae** Bonaparte, 1850 (13 genera; 67 species)⁵⁴
 Subfamily **Cacosterninae** Noble, 1931 (11 genera; 61 species)
 Subfamily **Pyxicephalinae** Bonaparte, 1850 (2 genera; 6 species)
 Family **Ranidae** Rafinesque, 1814 (10–16 genera; 369 species)⁵⁵
 Family **Ranixalidae** Dubois, 1987 (1 genus; 10 species)⁵⁶
 Family **Rhacophoridae** Hoffman, 1932 (15 genera; 333 species)⁵⁷
 Subfamily **Buergeriinae** Channing, 1989 (1 genus; 5 species)

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43. From one to three families of myobatrachids (Myobatrachidae, Limnodynastidae, Rheobatrachidae) have been recognized. Ford & Cannatella (1993) questioned the monophyly of a single family (e.g., Heyer & Liem, 1976) and proposed that †*Rheobatrachus* may be most closely related to the Myobatrachinae (sensu Heyer & Liem, 1976). Several molecular phylogenetic analyses did not test the monophyly of each family (e.g., Read *et al.*, 2001; Morgan *et al.*, 2007). Frost *et al.* (2006) found that twenty genera variously assigned to the three families form a clade, yet chose to recognize two families (Limnodynastidae and Myobatrachidae, the latter containing *Mixophyes* and †*Rheobatrachus*). Much of the uncertainty of higher-level taxonomy in this clade relates to *Mixophyes* and †*Rheobatrachus*, the relationships of which remain uncertain (Heyer & Liem, 1976; Farris *et al.*, 1982; Frost *et al.*, 2006; Roelants *et al.*, 2007; Ruane *et al.*, 2011; Pyron & Wiens, 2011). In several analyses, *Mixophyes* and †*Rheobatrachus* are not sister taxa and the relationships of these two genera to the other taxa in the Limnodynastidae and Myobatrachidae (sensu Frost *et al.*, 2006) remain unclear (Roelants *et al.*, 2007; Pyron & Wiens, 2011; Ruane *et al.*, 2011). Bossuyt & Roelants (2009) recognized Rheobatrachidae, Limnodynastidae, and Myobatrachidae but mentioned neither †*Rheobatrachus* nor *Mixophyes* explicitly. To date, the most complete relevant analyses are those of Frost *et al.* (2006) and Pyron & Wiens (2011), which largely agree with one another, yet disagree on whether *Rheobatrachus* and *Mixophyes* form a clade. Because of remaining uncertainties in the placement of †*Rheobatrachus* and *Mixophyes*, we follow Pyron & Wiens (2011) by using two subfamilies for the single family Myobatrachidae. The genus †*Rheobatrachus* became extinct in the late 20th century.
44. The monotypic family Nasikabatrachidae (Biju & Bossuyt, 2003) is nearly universally accepted, although Frost *et al.* (2006) included the sole genus in the Sooglossidae. We follow the generally accepted practice of maintaining these as two distinct families (e.g., Frost, 2011; Pyron & Wiens, 2011).
45. Frost *et al.* (2006) subsumed the Lankanectinae and Nyctibatrachinae of Dubois (2005) into a single family, Nyctibatrachidae. The monophyly of this family, containing the two genera *Lankanectes* and *Nyctibatrachus*, receives high support from phylogenetic analyses (van der Meijden *et al.*, 2005; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Wiens *et al.*, 2009; Ruane *et al.*, 2011; Pyron & Wiens, 2011; see also Dubois & Ohler, 2001). For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.
46. Pyron & Wiens (2011) found strong support for the monophyly of a clade of three genera (*Macrotenioglottus*, *Odontophrynus*, and *Proceratophrys*), which they recognized as the Odontophrynidae. See also footnote 8.
47. †Palaeobatrachidae contains four recognized extinct genera (†*Albionbatrachus*, †*Messelobatrachus*, †*Palaeobatrachus*, and †*Pliobatrachus*) and is generally allied to the extant Pipidae although the phylogenetic relationships of this family remain obscure (Sanchíz, 1998). The phylogenetic analyses of Gao & Wang (2001) and Gao & Chen (2004), which included †*Palaeobatrachus*, suggest that †Palaeobatrachidae may nest within the Pipidae, but a phylogenetic analysis with greater taxonomic sampling of extinct pipoid taxa supports the monophyly of Pipidae to the exclusion of †*Palaeobatrachus* (Trueb & Báez, 2006; see also Roček, 2003).
48. The well-supported Pelobatidae contains a single genus (*Pelobates*) with four species (Cannatella, 1985; Ford & Cannatella, 1993; Lathrop, 1997; García-Paris *et al.*, 2003; Roelants & Bossuyt, 2005; Frost *et al.*, 2006; Veith *et al.*, 2006). Based in part on the morphological phylogenetic analysis of Cannatella (1985), Ford & Cannatella (1993) defined Pelobatidae to include *Pelobates* as well as *Scaphiopus* and *Spea* (see also, e.g., Noble, 1925). Analyses of morphological data by Lathrop (1997), Henrici & Haynes (2006), and Henrici (2009) further support this result as well as including the extinct taxa †*Elkobatrachus*, †*Macropelobates*, and †*Eopelobates* in the Pelobatidae. However, subsequent molecular phylogenetic analyses, as well as a combined analysis of larval and adult morphology (Pugener *et al.*, 2003) indicate that *Pelobates*, *Scaphiopus*, and *Spea* do not form a clade exclusive of Pelodytidae and Megophryidae (see also footnote 39). We follow the results of these recent studies by recognizing Pelobatidae and Scaphiopodidae to be distinct families, although the relationships of the extinct taxa now remain uncertain and we consider these *Anura incertae sedis*.
49. The monophyly of the Pelodytidae, which contains a single genus (*Pelodytes*) with three species, is supported by phylogenetic analysis of mitochondrial DNA sequence data (García-Paris *et al.*, 2003). Analyses of both morphological and molecular data support the Pelodytidae as a member of a larger clade containing the Pelobatidae, Scaphiopodidae, and Megophryidae (Cannatella, 1985; Ford & Cannatella, 1993; Hay *et al.*, 1995; García-Paris *et al.*, 2003; Pugener *et al.*, 2003; Roelants & Bossuyt, 2005; San Mauro *et al.*, 2005; Frost *et al.*, 2006; Veith *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Ruane *et al.*, 2011). †*Miopelodytes* and †*Tephrodytes* have been included in the Pelodytidae based on the fusion of the tibiale and fibulare (unique among archaeobatrachians; Cannatella, 1985), but the precise relationships of these two genera to *Pelodytes* remains unclear (Taylor, 1941; Henrici, 1994).
50. See footnote 23.
51. The monophyly of the Phrynobatrachidae, containing the single diverse genus *Phrynobatrachus*, is well supported by phylogenetic analyses (Scott, 2005; Bossuyt *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens *et al.*, 2009; Ruane *et al.*, 2011; Zimkus *et al.*, 2010). While combined molecular and morphological data of Scott (2005) suggested paraphyly of *Phrynobatrachus* with respect to *Natalobatrachus*, the recent phylogenetic analysis of van der Meijden *et al.* (2011) demonstrate *Natalobatrachus* to be within the Pyxicephalidae. For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.

Subfamily **Rhacophorinae** Hoffman, 1932 (14 genera; 327 species)
 Family **Rhinodermatidae** Günther, 1858 (2 genera; 3 species)⁵⁸
 Family **Rhinophrynidae** Günther, 1859 (1 genus; 1 species; †2–3)⁵⁹
 Family **Scaphiopodidae** Cope, 1865 (2 genera; 7 species)⁶⁰
 Family **Sooglossidae** Noble, 1931 (2 genera; 4 species)⁶¹
 Family **Strabomantidae** Hedges, Duellman, & Heinicke, 2008 (17–19 genera; 572 species)⁶²
 Subfamily **Holoadeninae** Hedges, Duellman, & Heinicke, 2008 (6 genera; 47 species)
 Subfamily **Strabomantinae** Hedges, Duellman, & Heinicke, 2008 (11–13 genera; 525 species)
 Family **Telmatobiidae** Fitzinger, 1843 (2 genera; 60 species)⁶³
 Order **Caudata** Fischer von Waldheim, 1813 (salamanders) (67–68 genera; 614 species; †~66)⁶⁴

52. Phylogenetic analyses of morphological and molecular data support the monophyly of the Pipidae (Cannatella, 1985; Cannatella & Trueb, 1988ab; Ford & Cannatella, 1993; Haas, 2003; Pugener *et al.*, 2003; Evans *et al.*, 2004; Roelants & Bossuyt, 2005; San Mauro *et al.*, 2005; Frost *et al.*, 2006; Trueb & Báez, 2006; Marjanović & Laurin, 2007; Roelants *et al.*, 2007; Wiens, 2007; Irisarri *et al.*, 2011; Ruane *et al.*, 2011). The relationships of *Hymenochirus* and *Pseudhymenochirus* are unclear; some studies find these genera (typically represented only by *Hymenochirus*) to be more closely related to extant *Xenopus* (including *Silurana*; Roelants & Bossuyt, 2005; San Mauro *et al.*, 2005; Roelants *et al.*, 2007; Wiens, 2007; Irisarri *et al.*, 2011; Ruane *et al.*, 2011), or to *Pipa* (Cannatella, 1985; Cannatella & Trueb, 1988ab; Evans *et al.*, 2004; Pugener *et al.*, 2003; Báez & Harrison, 2005; Trueb *et al.*, 2005; Marjanović & Laurin, 2007), or possibly sister to a clade containing both *Xenopus* and *Pipa* (Frost *et al.*, 2006); see also de Sá & Hillis (1990). Because of these uncertainties, we refrain from recognizing subfamilies within the Pipidae. Cannatella & Trueb (1988a) recognized the genus *Silurana* as distinct from *Xenopus*, although one of these authors states that this was an unsound decision (Pauly *et al.*, 2009). Diverse extinct taxa of the Pipidae include †*Eoxenopoides*, †*Llankibatrachus*, †*Pachycentrata* (Pipinae; Báez & Harrison, 2005; Trueb & Báez, 2006), †*Saltenia*, †*Shelania*, †*Singidella* (Pipinae; Báez & Harrison, 2005), and †*Vulcanobatrachus*. Other extinct taxa that may be more closely related to Pipidae than to Rhinophrynidae include †*Avitabatrachus*, †*Cordicephalus*, and †*Thoraciliacus*, and possibly the Palaeobatrachidae (Báez *et al.*, 2000; Trueb *et al.*, 2005; Trueb & Báez, 2006), but we do not include these taxa within the Pipidae.
53. The monophyly of the Ptychadenidae receives strong support from phylogenetic analyses (Scott, 2005; Bossuyt *et al.*, 2006; van Bocxlaer *et al.*, 2006; Wiens *et al.*, 2009). For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.
54. Phylogenetic analyses of molecular data provide strong support for the monophyly of the African endemic family Pyxicephalidae (van der Meijden *et al.*, 2005, 2011; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Wiens *et al.*, 2009; Zimkus *et al.*, 2010; Pyron & Wiens, 2011) and its component subfamilies Cacosterninae and Pyxicephalinae (Scott, 2005; van der Meijden *et al.*, 2005, 2011; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens *et al.*, 2009; Zimkus *et al.*, 2010; Pyron & Wiens, 2011). For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.
55. Phylogenetic analyses of molecular data provide strong support for the monophyly of the African endemic family Pyxicephalidae (van der Meijden *et al.*, 2005, 2011; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Wiens *et al.*, 2009; Zimkus *et al.*, 2010; Pyron & Wiens, 2011) and its component subfamilies Cacosterninae and Pyxicephalinae (Scott, 2005; van der Meijden *et al.*, 2005, 2011; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens *et al.*, 2009; Zimkus *et al.*, 2010; Pyron & Wiens, 2011). For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.
56. The Ranixalidae, containing only the genus *Indirana*, a well supported clade (Roelants *et al.*, 2004, 2007; Bossuyt *et al.*, 2006; Van Bocxlaer *et al.*, 2006; Wiens *et al.*, 2009; Ruane *et al.*, 2011; Pyron & Wiens, 2011). For further details on taxonomy of taxa placed in the Ranidae of Dubois (2005), see footnote 20.
57. Rhacophoridae and its two subfamilies are clades (Emerson *et al.*, 2000; Haas, 2003; Kurabayashi *et al.*, 2005; Scott, 2005; van der Meijden *et al.*, 2005; Bossuyt *et al.*, 2006; Frost *et al.*, 2006; Vences *et al.*, 2003bc; Van Bocxlaer *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Li *et al.*, 2009; Wiens *et al.*, 2009; Yu *et al.*, 2009; Ruane *et al.*, 2011; Pyron & Wiens, 2011). Phylogenetic analyses led to the recognition of several additional rhacophorine genera (Biju *et al.*, 2010; Meegaskumbura *et al.*, 2010). For further details on taxa placed in the Ranidae by Dubois (2005), see footnote 20.
58. See footnote 8.
59. The Rhinophrynidae, represented today only by the monotypic *Rhinophrynus*, is the sister taxon of the extant Pipidae (Cannatella, 1985; Hay *et al.*, 1995; Haas, 2003; Pugener *et al.*, 2003; Roelants & Bossuyt, 2005; Frost *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Ruane *et al.*, 2011). The phylogenetic analyses of Gao & Wang (2001) and Gao & Chen (2004) support a sister relationship of *Rhinophrynus* with †*Palaeobatrachus*, but analyses with greater sampling of extinct pipoid taxa do not support this relationship (Trueb *et al.*, 2005; Trueb & Báez, 2006; Marjanović & Laurin, 2007). We follow Henrici (1998) by including the fossil taxa †*Chelomophrynus* and †*Rhadinosteus*, and possibly †*Eorhinophrynus*, in the Rhinophrynidae.
60. The genera *Scaphiopus* and *Spea* form the monophyletic Scaphiopodidae (Cannatella, 1985; Lathrop, 1997; García-París *et al.*, 2003; Roelants & Bossuyt, 2005; Frost *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Ruane *et al.*, 2011), which Ford & Cannatella (1993) included in the Pelobatidae. While the phylogenetic analyses of morphological data by Henrici & Haynes (2006) and Henrici (2009) did not resolve *Scaphiopus* and *Spea* as sister taxa to the exclusion of *Pelobates*, other phylogenetic analyses present evidence that these two genera form a clade. The phylogenetic relationships and family-level taxonomy of fossil taxa previously allied to *Pelobates*, *Scaphiopus*, and *Spea* remain unclear (Zweifel, 1956; Henrici & Haynes, 2006; Henrici, 2009) and we thus leave these unassigned to family. See also footnote 48.
61. Sooglossidae is a well supported clade (Nussbaum, 1982; Ford & Cannatella, 1993; Nussbaum & Wu, 2007; Frost *et al.*, 2006; van der Meijden *et al.*, 2007a; Pyron & Wiens, 2011). Partitioning of the diversity of this family into genera is supported by morphological, molecular, and acoustic data (Nussbaum & Wu, 2007; van der Meijden *et al.*, 2007a; see also Nussbaum *et al.*, 1982).
62. Hedges *et al.* (2008) proposed the Strabomantidae and its two subfamilies (Holoadeninae and Strabomantinae) for a diverse clade of Central and South American genera. Strabomantidae is one of four families in the unranked taxon Terrarana (Hedges *et al.*, 2008; Heinicke *et al.*, 2009). Subsequent molecular phylogenetic analyses with less taxon sampling have not resolved the two subfamilies as monophyletic (Heinicke *et al.*, 2007, 2009), or even as forming a clade (Padial *et al.*, 2009), but because these are based on substantially less sampling of taxa and/or genetic loci, we follow the subfamily taxonomy proposed by Hedges *et al.* (2008). See also footnote 24.
63. See footnote 8.

Family **Ambystomatidae** Gray, 1850 (1 genus; 32 species; †2)⁶⁵
 Family **Amphiumidae** Gray, 1825 (1 genus; 3 species; †1)⁶⁶
 Family †**Batrachosauroididae** Auffenberg, 1958 (†7)⁶⁷
 Family **Cryptobranchidae** Fitzinger, 1826 (2 genera; 3 species; †6)⁶⁸
 Family **Dicamptodontidae** Tihen, 1958 (1 genus; 4 species; †5)⁶⁹
 Family **Hynobiidae** Cope, 1859 (9 genera; 53 species; †1)⁷⁰
 Family †**Karauridae** Ivachnenko, 1978 (†2–3)⁷¹
 Family **Plethodontidae** Gray, 1850 (27 genera; 418 species)⁷²
 Subfamily **Hemidactyliinae** Hallowell, 1856 (20 genera; 322 species)
 Subfamily **Plethodontinae** Gray, 1850 (7 genera; 96 species)
 Family **Proteidae** Gray, 1825 (2 genera; 6 species; †2)⁷³
 Subfamily **Proteinae** Gray, 1825 (1 genus; 1 species; †2)

64. We consider Caudata and Urodela to be synonyms and follow the argumentation of Frost *et al.* (2006) by recognizing Caudata as the appropriate name (for a contrasting view, see Dubois, 2004). Family-level assignment is currently not possible for ~25 extinct genera. Of these, †*Karaurus* and †*Kokartus* may be outside crown-group Caudata. Unassigned taxa, some of which are based on very limited material (e.g., †*Galverpeton*), are †*Apricosiren*, †*Batrachosauroides*, †*Bishara*, †*Chrysotriton*, †*Chunerpeton*, †*Comonecturoides*, †*Galverpeton*, †*Hemitrypus*, †*Hylaeobatrachus*, †*Iridotriton*, †*Jeholotriton*, †*Kiyatriton*, †*Laccotriton*, †*Liaoxitriton*, †*Marmorerpeton*, †*Mynbulakia*, †*Nesovtriton*, †*Paleoamphiuma*, †*Pangerpeton*, †*Prosiren*, †*Ramonellus*, †*Regalerpeton*, †*Seminobatrachus*, †*Sinerpeton*, †*Triassurus* (possibly not within Caudata; Estes, 1981; Milner, 2000), and †*Valdotriton*.
65. The monophyly is well established for Ambystomatidae and Dicamptodontidae, and the clades are sister taxa (Larson, 1991; Larson & Dimmick, 1993; Frost *et al.*, 2006; Roelants *et al.*, 2007; Vieites *et al.*, 2007, 2009; Wiens, 2007; Zhang & Wake, 2009a; Pyron & Wiens, 2011). Frost *et al.* (2006) reduced Dicamptodontidae to a subfamily of Ambystomatidae to avoid two taxa each with only one genus. Significantly, the decision by Frost *et al.* (2006) to place the Dicamptodontidae in the Ambystomatidae because “each contain[s] a single genus” (p. 118) disregards the long recognition of extinct genera as belonging to these families (e.g., Estes, 1981). In light of the deep separation of the taxa (probably in excess of 100 my: Roelants *et al.*, 2007; Zhang & Wake, 2009a; Vieites *et al.*, 2009), the long fossil record of dicamptodontids, documentation of their former occurrence in Europe (Venczel, 2008), and substantial biological differences between the two clades, we recognize these as two distinct families. We follow Estes (1981) by including five extinct genera (†*Ambystomichnus* [an ichnotaxon; Peabody, 1954], †*Bargmannia*, †*Chrysotriton*, †*Geyeriella*, and †*Wolterstorffella*) in the Dicamptodontidae. While we agree with Milner (2000) that the inclusion of these in Dicamptodontidae is based on very limited data (i.e., vertebral morphology; Estes, 1981), it is the only evidence at hand and serves as a hypothesis to be tested with additional data. Rogers (1976) described †*Amphitriton* as an extinct genus of Ambystomatidae; Estes (1981) and Milner (2000) have shown that the morphological features of this extinct taxon fall within the diversity observed in *Ambystoma*.
66. The monophyletic Amphiumidae contains three extant species of *Amphiuma*. Amphiumidae is the sister-taxon of the Plethodontidae (Larson & Dimmick, 1993; Frost *et al.*, 2006; Roelants *et al.*, 2007; Vieites *et al.*, 2007, 2009; Wiens, 2007; Zhang & Wake, 2009a; Pyron & Wiens, 2011). We include †*Proamphiuma*, and refrain from including †*Paleoamphiuma* because of disagreements as to its affinities (Rieppel & Grande, 1998; Gardner, 2003).
67. The †Batrachosauroididae is an extinct, enigmatic family of uncertain phylogenetic affinity with seven currently recognized genera (†*Batrachosauroides*, †*Mynbulakia*, †*Opisthotriton*, †*Palaeoproteus*, †*Parrisia*, †*Peratosauroides*, and †*Prodesmodon*; Estes, 1969; Denton & O’Neill, 1998; Milner 2000). Estes (1981) considered batrachosauroidids to be closely related to extant proteids. Other enigmatic genera such as †*Hylaeobatrachus* and †*Prosiren* may also belong to this lineage (Milner, 2000).
68. The monophyletic Cryptobranchidae (e.g., Wiens, 2007; Zhang & Wake, 2009a; Pyron & Wiens, 2011) contains two extant genera (*Andrias* and *Cryptobranchus*) and two extinct genera (†*Aviturus* and †*Ulanurus*). Gubin (1991) placed †*Aviturus* and †*Ulanurus* in the subfamily †*Aviturinae* within the Cryptobranchidae, but we refrain from recognizing this subfamily taxonomy pending cladistic analyses. Four other extinct genera (†*Chunerpeton*, †*Jeholotriton*, †*Pangerpeton*, and †*Regalerpeton*) form a clade with extant cryptobranchids exclusive of other salamanders but these have not been formally included within the Cryptobranchidae (Zhang *et al.* 2009; Skutschas & Gubin, in press; see also Wang & Evans, 2006). Estes (1981) provides details on other taxa considered junior synonyms of *Andrias*. Skutschas (2009) also includes both †*Eoscapherpeton* and †*Horezmia* in the Cryptobranchidae.
69. See footnote 65.
70. Hynobiidae is monophyletic (e.g., Frost *et al.*, 2006; Zhang & Wake, 2009a; Zheng *et al.*, 2011; Pyron & Wiens, 2011) and sister to the Cryptobranchidae (Larson, 1991; Larson & Dimmick, 1993; Frost *et al.*, 2006; Roelants *et al.*, 2007; Vieites *et al.*, 2007, 2009; Wiens, 2007; Zhang & Wake, 2009a; San Mauro, 2010; Pyron & Wiens, 2011). A close relationship between the Hynobiidae and Cryptobranchidae is supported by morphological data (Noble, 1925; Larsen, 1963; Larson & Dimmick, 1993). Molecular phylogenetic analysis of the recently rediscovered *Protohynobius puxiongensis* reveals that it is closely related to *Pseudohynobius* and nested well within Hynobiidae (Peng *et al.*, 2010), thus invalidating the former subfamily Protohynobinae (Fei & Ye, 2000). We follow Venczel (1999) by including the extinct †*Parahynobius* in the Hynobiidae.
71. †Karauridae is an extinct family comprising two genera (†*Karaurus* and †*Kokartus*) from the Jurassic of middle Asia (Ivachnenko, 1978; Nessov, 1988). The †Karauridae is believed to be the sister taxon of extant salamanders (Evans & Milner, 1996; Evans *et al.*, 2005; Skutschas & Martin, 2011; Skutschas & Gubin, in press). Another extinct genus, †*Marmorerpeton*, may be allied to the †Karauridae (Milner, 2000).
72. Evidence for two major clades within the Plethodontidae is strong (Vieites *et al.*, 2007, 2011; Camp *et al.*, 2009) and two subfamilies, Hemidactyliinae and Plethodontinae, are recognized (contra Pyron & Wiens, 2011). Vieites *et al.* (2011) recognized four tribes in the Hemidactyliinae and five in the Plethodontinae; their Bolitoglossini and Spelerpini were treated as subfamilies by Chippindale *et al.* (2004) and Pyron & Wiens, (2011). Each subfamily and each tribe is well resolved as monophyletic in molecular phylogenetic analyses (e.g., Chippindale *et al.*, 2004; Mueller *et al.*, 2004; Macey, 2005; Min *et al.*, 2005; Frost *et al.*, 2006; Wiens, 2007; Kozak *et al.*, 2009; Vieites *et al.*, 2011; Pyron and Wiens, 2011). However, inferred relationships among the tribes have changed over time with increases in phylogenetic data (Hedges & Maxson, 1993; Hay *et al.*, 1995; Chippindale *et al.*, 2004; Mueller *et al.*, 2004; Macey, 2005; Min *et al.*, 2005; Frost *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Kozak *et al.*, 2009; Vieites *et al.*, 2011).

Subfamily **Necturinae** Fitzinger, 1843 (1 genus; 5 species)
 Family **Rhyacotritonidae** Tihen, 1958 (1 genus; 4 species)⁷⁴
 Family **Salamandridae** Goldfuss, 1820 (21–22 genera; 86 species; †9)⁷⁵
 Subfamily **Pleurodelinae** Tschudi, 1838 (16–17 genera; 69 species; †7)
 Subfamily **Salamandrinae** Goldfuss, 1820 (4 genera; 15 species; †1)
 Subfamily **Salamandrininae** Fitzinger, 1843 (1 genus; 2 species)
 Family †**Scapherpetontidae** Auffenberg & Goin, 1959 (†3)⁷⁶
 Family **Sirenidae** Gray, 1825 (2 genera; 4 species; †3)⁷⁷
 Order **Gymnophiona** Müller, 1832 (caecilians) (31 genera; 188; †3)⁷⁸
 Family **Caeciliidae** Rafinesque, 1814 (2 genera; 42 species)⁷⁹
 Family **Dermophiidae** Taylor, 1969 (4 genera; 14 species; †1)⁸⁰
 Family **Herpeliidae** Laurent, 1984 (2 genera; 9 species)⁸¹
 Family **Ichthyophiidae** Taylor, 1968 (3 genera; 50 species)⁸²
 Family **Indotyphlidae** Lescure, Renous & Gasc, 1986 (7 genera; 21 species)⁸³
 Family **Rhinatrematidae** Nussbaum, 1977 (2 genera; 11 species)⁸⁴
 Family **Scolecomorphidae** Taylor, 1969 (2 genera; 6 species)⁸⁵

73. Monophyly of the Proteidae has long been debated (e.g., Larsen & Guthrie, 1974; Hecht & Edwards, 1976). Molecular phylogenetic studies recover a monophyletic Proteidae but with very long internal branches and a split likely in excess of 120 my (Frost *et al.*, 2006; Roelants *et al.*, 2007; Wiens, 2007; Zhang & Wake, 2009a). While we recognize a single family, there are extinct taxa assigned to Proteinae and a reasonable alternative would be to raise the subfamilies (Proteinae and Necturinae) to family level (Zhang & Wake, 2009a). The extinct taxa †*Mioproteus* and †*Orthophya* are morphologically similar to *Proteus* (Estes, 1981; Milner, 2000) and we place these genera in the Proteinae.
74. The Rhyacotritonidae, containing only the genus *Rhyacotriton*, is sister to the clade comprising the Amphiumidae and Plethodontidae (Mueller *et al.*, 2004; Min *et al.*, 2005; Frost *et al.*, 2006; Wiens *et al.*, 2005; Roelants *et al.*, 2007; Vieites *et al.*, 2007, 2011; Wiens, 2007; Zhang & Wake, 2009a; Pyron & Wiens, 2011; Zheng *et al.*, 2011).
75. Monophyly of the Salamandridae is well established based on morphological and molecular evidence (Wake & Özeti, 1969; Titus & Larson, 1995; Frost *et al.*, 2006; Wiens, 2007; Roelants *et al.*, 2007; Zhang *et al.*, 2008; Zhang & Wake, 2009a; Pyron & Wiens, 2011). Molecular phylogenetic analyses reveal three well resolved clades of salamandrids (Weisrock *et al.*, 2006; Zhang *et al.*, 2008; Pyron & Wiens, 2011) that are each now recognized as a subfamily (Dubois & Raffaëlli, 2009). Following Estes (1981) and Dubois & Raffaëlli (2009), we recognize nine extinct genera in the Salamandridae, with seven in the Pleurodelinae (†*Brachycormus*, †*Carpathotriton*, †*Chelotriton*, †*Koallelia*, †*Oligosemia* [considered a possible synonym of *Triturus* by Estes, 1981], †*Palaeopleurodeles*, and †*Procnops*) and one in the Salamandrinae (†*Megalotriton*). Unlike Dubois & Raffaëlli (2009), we consider the extinct †*Archaeotriton* as Salamandridae *incertae sedis* because its affinities remain unclear (Estes, 1981; Venczel, 2008).
76. The extinct family †Scapherpetontidae includes three genera: †*Lisserpeton*, †*Piceoerpeton*, and †*Scapherpeton* (Estes, 1969; Naylor & Krause, 1981). Following Estes (1981), we recognize this as a distinct taxon instead of subsuming these genera within the Dicamptodontidae based on vertebral morphology (i.e., Edwards, 1976). The relationship of the †Scapherpetontidae to other salamander families remains unclear.
77. The phylogenetic relationship of the two genera of the Sirenidae (*Pseudobranchius* and *Siren*) to other salamanders has long been enigmatic (e.g., Boyden & Noble, 1933; Larsen, 1963; Estes, 1965). Its monophyly is well established, with most studies resolving it as the sister to a large clade (Salamandroidea) containing Ambystomatidae, Dicamptodontidae, Plethodontidae, Proteidae, Rhyacotritonidae, and Salamandridae (Wiens *et al.*, 2005; Roelants *et al.*, 2007; Wiens, 2007; Pyron & Wiens, 2011), although Zhang & Wake (2009a), using complete mitochondrial genomes, found Sirenidae to be sister to all other salamanders. We follow Evans *et al.* (1996) by including three extinct genera in the Sirenidae (†*Habrosaurus*, †*Kababisha*, and †*Noterpeton*), though we note that the affinities of these taxa remain enigmatic (Rage *et al.*, 1993; Milner, 2000).
78. Doubts about monophyly led Frost *et al.* (2006) to recognize only three families: Caeciliidae, Typhlonectidae, and Rhinatrematidae. In order to resolve apparent paraphyly, Wilkinson *et al.* (2011) recognized nine families. Their classification is compatible with the results of the most comprehensive molecular phylogenetic analyses (Roelants *et al.*, 2007; Zhang & Wake, 2009b; Pyron & Wiens, 2011), yet many taxa remain unsampled. We adopt the classification of Wilkinson *et al.* (2011), which identifies major clades and presents detailed justifications for recognizing these as families (rather than subfamilies as in Pyron & Wiens, 2011); because of this recent presentation, we do not go into detailed summaries for each family of caecilians. The Caeciliidae (sensu Nussbaum & Wilkinson, 1989; see also Wilkinson & Nussbaum, 2006) is the family-level taxon most affected by changes proposed by Wilkinson *et al.* (2011); it is divided into five families (Caeciliidae, Dermophiidae, Herpeliidae, Indotyphlidae, and Siphonopidae). †*Apodops*, described by Estes & Wake (1972) as a caeciliid based on stated similarities to *Dermophis*, *Gymnophis*, and *Geotrypetes*, is tentatively placed in the Dermophiidae (M. Wake, pers. comm.). Of the three extinct genera of Gymnophiona, only †*Apodops* is within crown-group Gymnophiona; †*Eocaecilia* and *Rubricaecilia* are likely sister to extant caecilians (Jenkins & Walsh, 1993; Evans & Sigogneau-Russell, 2001; Jenkins *et al.*, 2007).
79. See footnote 78.
80. See footnote 78.
81. See footnote 78.
82. Most phylogenetic analyses agree in finding a close relationship between the Ichthyophiidae and the former Uraeotyphlidae (Wilkinson & Nussbaum, 1996; Gower *et al.*, 2002; Wilkinson *et al.*, 2003; San Mauro *et al.*, 2004b, 2009; Frost *et al.*, 2006; Loader *et al.*, 2007; Roelants *et al.*, 2007; Gower *et al.*, 2008; Gower & Wilkinson, 2009; Zhang & Wake, 2009b), although most of these studies are based on a single representative of each taxon. Frost *et al.* (2006) subsumed the Uraeotyphlidae within the Ichthyophiidae based on data for three specimens, one of which was unidentified to species. In studies with richer taxon sampling, Gower *et al.* (2002), Zhang & Wake (2009b), and Pyron & Wiens (2011) found *Ichthyophis* to be paraphyletic with respect to *Uraeotyphlus*, and *Ichthyophis* is paraphyletic with respect to *Caudicaecilia* (Roelants *et al.*, 2007; Zhang & Wake, 2009b; Pyron & Wiens, 2011). The validity of genera in the Ichthyophiidae requires further research (i.e., Wilkinson *et al.*, 2011).
83. See footnote 78.

Family **Siphonopidae** Bonaparte, 1850 (7 genera; 22 species)⁸⁶

Family **Typhlonectidae** Taylor, 1968 (4 genera; 13 species)⁸⁷

Cited References

- Aguilar, C. & Pacheco, V. (2005) Contribución de la morfología bucofaringea larval a la filogenia de *Batrachophrynus* y *Telmatobius*. *Monografía Herpetología*, 7, 219–238.
- Aguilar, C. & Valencia, N. (2009) Relaciones filogenéticas entre telmatobiinidos (Anura, Ceratophryidae, Telmatobiinae) de los Andes centrales basado en la morfología de los estados larval y adultos. *Revista Peruana de Biología*, 16, 43–50.
- Alcalde, L. & Blotto, B.L. (2006) Chondrocranium, cranial muscles, and buccopharyngeal morphology on tadpoles of the controversial leptodactylid frog *Limnomedusa macroglossa* (Anura: Leptodactylidae). *Amphibia-Reptilia*, 27, 241–253.
- Anderson, J.S. (2008) Focal review: The origin(s) of modern amphibians. *Evolutionary Biology*, 35, 231–247.
- Anderson, J.S., Reisz, R.R., Scott, D., Fröbisch, N.B. & Sumida, S.S. (2008) A stem batrachian from the Early Permian of Texas and the origin of frogs and salamanders. *Nature*, 453, 515–518.
- Austin, J.D., Loughheed, S.C., Tanner, K., Chek, A.A., Bogart, J.P. & Boag P.T. (2002) A molecular perspective on the evolutionary affinities of an enigmatic neotropical frog, *Allophryne ruthveni*. *Zoological Journal of the Linnean Society*, 134, 335–346.
- Báez, A.M. & Basso, N.G. (1996) The earliest known frogs of the Jurassic of South America: review and cladistics appraisal of their relationships. *Münchner Geowissenschaftliche Abhandlungen*, 30, 131–158.
- Báez, A.M. & T. Harrison (2005) A new pipine frog from an Eocene crater lake in north-central Tanzania. *Palaeontology*, 48, 723–737.
- Báez, A.M., Trueb, L. & Calvo, J.O. (2000) The earliest known pipoid frog from South America: a new genus from the Middle Cretaceous of Argentina. *Journal of Vertebrate Paleontology*, 20, 490–500.
- Biju, S.D. & Bossuyt, F. (2003) New frog family from India reveals an ancient biogeographical link with the Seychelles. *Nature*, 425, 711–714.
- Biju, S.D., Schouche, Y., Dubois, A., Dutta, S.K. & Bossuyt, F. (2010) A ground-dwelling rhacophorid frog from the highest mountain peak of the Western Ghats of India. *Current Science*, 98, 1119–1125.
- Blackburn, D.C. (2008) Biogeography and evolution of body size and life history of African frogs: phylogeny of squeakers (*Arthroleptis*) and long-fingered frogs (*Cardioglossa*) estimated from mitochondrial data. *Molecular Phylogenetics and Evolution*, 49, 806–826.
- Blackburn, D.C., Bickford, D.P., Diesmos, A.C., Iskandar, D.T. & Brown, R.M. (2010) An ancient origin for the enigmatic flat-headed frogs (Bombinatoridae: *Barbourula*) from the islands of southeast Asia. *PLoS ONE*, 5, e12090.
- Blommers-Schlösser, R.M.A. (1993) Systematic relationship of the Mantellinae Laurent 1946. *Ethology, Ecology & Evolution*, 5, 199–218.
- Bogart, J.P. (1991) The influence of life history on karyotypic evolution in frogs. In: Green, D.M. & Sessions, S.K. (Eds.), *Amphibian Cytogenetics and Evolution*. Academic Press, San Diego, pp. 233–258.
- Bolt, J.R. (1991) Lissamphibian origins. In: Schultze, H.-P. & Trueb, L. (Eds.), *Origins of the Higher Groups of Tetrapods: Controversy and Consensus*. Cornell University Press, Ithaca, pp. 194–222.
- Bossuyt, F., Brown, R.M., Hillis, D.M., Cannatella, D.C. & Milinkovitch, M. (2006) Phylogeny and biogeography of a cosmopolitan frog radiation: Late Cretaceous diversification resulted in continent-scale endemism in the family Ranidae. *Systematic Biology*, 55, 579–594.
- Bossuyt, F. & Roelants, K. (2009) Frogs and toads (Anura). In: Hedges, S.B. & Kumar, S. (Eds.), *The Timetree of Life*. Oxford University Press, New York, pp. 357–364.
- Boyden, A. & Noble, G.K. (1933) The relationships of some common Amphibia as determined by serological study. *American Museum Novitates*, 606, 1–24.
- Camp, C. D., Peterman, W.E., Milanovich, J.R., Lamb, T., Maerz, J.C. & Wake, D.B. (2009) A new genus and species of lungless salamander (family Plethodontidae) from the Appalachian highlands of the south-eastern United States. *Journal of Zoology*, 279, 86–94.
- Cannatella, D.C. (1985) *A Phylogeny of Primitive Frogs (Archaeobatrachians)*. Unpublished Ph.D. Thesis, University of Kansas, Lawrence, Kansas, 404 pp.
- Cannatella, D.C. & Trueb, L. (1988a) Evolution of pipoid frogs: intergeneric relationships of the aquatic frog family Pipidae (Anura). *Zoological Journal of the Linnean Society*, 94, 1–38.
- Cannatella, D.C. & Trueb, L. (1988b) Evolution of pipoid frogs: morphology and phylogenetic relationships of *Pseudhymenochirus*. *Journal of Herpetology*, 22, 439–456.
- Cárdenas-Rojas, D.R., Rabanal, F. & Formas, J.R. (2007) The tadpole of *Hylorhina sylvatica* (Anura: Cyclorhampidae) in southern Chile. *Zootaxa*, 1580, 51–62.
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84. Rhinatrematidae is monophyletic (Wilkinson & Nussbaum, 1996; Frost *et al.*, 2004; Roelants *et al.*, 2007; Zhang & Wake, 2009b) and is the sister taxon of all other living Gymnophiona (Hedges *et al.*, 1993; Wilkinson & Nussbaum, 1996; San Mauro *et al.*, 2004b, 2009; Frost *et al.*, 2006; Loader *et al.*, 2007; Roelants *et al.*, 2007; Gower *et al.*, 2008; Gower & Wilkinson, 2009; see also Wake, 1993).
85. The Scolecomorphidae is a morphologically distinctive clade (Frost *et al.*, 2006; Pyron & Wiens, 2011; Wilkinson *et al.*, 2011).
86. See footnote 77.
87. While Pyron & Wiens (2011) suggest paraphyly of the aquatic Typhlonectidae with respect to the terrestrial Caeciliidae of Wilkinson *et al.* (2011), their analysis includes but two typhlonectid genera. The morphological similarities among typhlonectids and their distinctiveness in relation to other caecilians are well established (Wilkinson & Nussbaum, 1997, 1999).

- Channing, A. (1995) The relationship between *Breviceps* (Anura: Microhylidae) and *Hemisus* (Hemisotidae) remains unequivocal. *Journal of the Herpetological Association of Africa*, 44, 55–57.
- Che, J., Hu, J.-S., Zhou, W.-W., Murphy, R.W., Papenfuss, T.J., Chen, M.-Y., Rao, D.-Q., Li, P.-P. & Zhang, Y.-P. (2009) Phylogeny of the Asian spiny frog tribe Paini (family Dicroglossidae) sensu Dubois. *Molecular Phylogenetics and Evolution*, 50, 59–73.
- Che, J., Pang, J., Zhao, H., Wu, G.-F., Zhao, E.-M. & Zhang, Y.-P. (2007) Molecular phylogeny of the Chinese ranids inferred from nuclear and mitochondrial DNA sequences. *Biochemical Systematics and Ecology*, 35, 29–39.
- Che, J., Zhou, W.-W., Hu, J.-S., Yan, F., Papenfuss, T.J., Wake, D.B. & Zhang, Y.-P. (2010) Spiny frogs (Paini) illuminate the history of the Himalayan region and Southeast Asia. *Proceedings of the National Academy of Sciences USA*, 107, 13765–13770.
- Córdova, J.H. & Descailleaux, J. (2005) El análisis cladístico preliminar de los cariotipos de cinco especies de *Telmatobius* y dos de *Batrachophrynus* no apoya su separación genérica. In: Lavilla, E.O. & De la Riva, I. (Eds.), *Estudio sobre las rana andinas de los géneros Telmatobius y Batrachophrynus* (Anura: Leptodactylidae). *Monografías de Herpetología*, 7. Asociación Herpetológica Española, Valencia, pp. 187–217.
- Correa, C., Veloso, A., Iturra, P. & Méndez, M.A. (2006) Phylogenetic relationships of Chilean leptodactylids: a molecular approach based on mitochondrial genes 12S and 16S. *Revista Chilena de Historia Natural*, 79, 435–450.
- Darst, C.R. & Cannatella, D.C. (2004) Novel relationships among hyloid frogs inferred from 12S and 16S mitochondrial DNA sequences. *Molecular Phylogenetics and Evolution*, 31, 462–475.
- de Sá, R.O., Heyer, W.R. & Camargo, A. (2005) A phylogenetic analysis of *Vanzolinius* Heyer, 1974 (Amphibia, Anura, Leptodactylidae): taxonomic and life history implications. *Arquivos do Museu Nacional, Rio de Janeiro*, 63, 707–726.
- de Sá, R.O. & Hillis, D.M. (1990) Phylogenetic relationships of the pipid frogs *Xenopus* and *Silurana*: an integration of ribosomal DNA and morphology. *Molecular Biology and Evolution*, 7, 365–376.
- Diaz, N.F. (1989) Phenetic and phylogenetic relationships of the Chilean *Alsodes* and *Telmatobius* (Amphibia, Leptodactylidae) and proposal of a new genus. *Studies on Neotropical Fauna and Environment*, 24, 25–33.
- Diaz, N.F. & Valencia, J. (1985) Larval morphology and phenetic relationships of the Chilean *Alsodes*, *Telmatobius*, *Caudiverbera*, and *Insuetophrynus*. *Copeia*, 1985, 175–181.
- Dubois, A. (1981) Liste des genres et sous-genres nominaux de Ranoidea (amphibiens anoures) du monde, avec identification de leurs espèces-types: conséquences nomenclaturales. *Monitore Zoologico Italiano, Supplemento*, 15, 225–284.
- Dubois, A. (1983) Classification et nomenclature supragénérique des Amphibiens Anoures. *Bulletin Mensuel de la Société Linnéenne de Lyon*, 52, 270–276.
- Dubois, A. (1992) Notes sur la classification des Ranidae (Amphibiens Anoures). *Bulletin Mensuel de la Société Linnéenne de Lyon*, 61, 305–332.
- Dubois, A. (2004) The higher nomenclature of recent amphibians. *Alytes*, 22, 1–14.
- Dubois, A. (2005) *Amphibia Mundi*. 1.1. An ergotaxonomy of recent amphibians. *Alytes*, 23, 1–24.
- Dubois, A. (2007) Naming taxa from cladograms: a cautionary tale. *Molecular Phylogenetics and Evolution*, 42, 317–330.
- Dubois, A. & Ohler, A. (2001) A new genus for an aquatic ranid (Amphibia, Anura) from Sri Lanka. *Alytes*, 19, 81–106.
- Dubois, A., Ohler, A. & Biju, S.D. (2001) A new genus and species of Ranidae (Amphibia, Anura) from south-western India. *Alytes*, 19, 53–79.
- Dubois, A. & Raffaëlli, J. (2009) A new ergotaxonomy of the family Salamandridae Goldfuss, 1820 (Amphibia, Urodela). *Alytes*, 26, 1–85.
- Duellman, W.E. (1970) *The Hyloid Frogs of Middle America*. Monograph of the Museum of Natural History, University of Kansas, Lawrence, Volumes I and II.
- Duellman, W.E., Junfer, K.-H. & Blackburn, D.C. (2011) The phylogenetic relationship of geographically separated “*Flectonotus*” (Anura: Hemiphractidae), as revealed by molecular, behavioral, and morphological data. *Phyllomedusa*, 10, 15–29.
- Duellman, W.E. & Trueb, L. (1986) *Biology of Amphibians*. McGraw-Hill, New York, 670 pp.
- Emerson, S.B., Richards, C., Drewes, R.C. & Kjer, K.M. (2000) On the relationships among ranoid frogs: a review of the evidence. *Herpetologica*, 56, 209–230.
- Estes, R. (1965) Fossil salamanders and salamander origins. *American Zoologist*, 5, 319–334.
- Estes, R. (1969) The Batrachosauroididae and Scapherpetontidae, Late Cretaceous and Early Cenozoic salamanders. *Copeia*, 1969, 225–234.
- Estes, R. (1981) Part 2. *Gymnophiona, Caudata*. *Handbuch der Paläoherpetologie*. P. Wellnhofer (Ed.). Fischer Verlag, Stuttgart, 115 pp.
- Estes, R. & Sanchíz, B. (1982) New discoglossid and palaeobatrachid frogs from the Late Cretaceous of Wyoming and Montana, and a review of other frogs from the Lance and Hell Creek Formations. *Journal of Vertebrate Paleontology*, 2, 9–20.
- Estes, R. & Wake, M.H. (1972) The first fossil record of caecilian amphibians. *Nature*, 239, 228–231.
- Evans, B.J., Kelley, D.B., Tinsley, R.C., Melnick, D.J. & Cannatella, D.C. (2004) A mitochondrial DNA phylogeny of African clawed frogs: phylogeography and implications for polyploid evolution. *Molecular Phylogenetics and Evolution*, 33, 197–213.
- Evans, S.E., Jones, M.E.H. & Krause, D.W. (2008) A giant frog with South American affinities from the Late Cretaceous of Madagascar. *Proceedings of the National Academy of Sciences USA*, 105, 2951–2956.
- Evans, S.E., Lally, C., Chure, D.C., Elder, A. & Maisano, J.A. (2005) A Late Jurassic salamander (Amphibia: Caudata) from the Morrison Formation of North America. *Zoological Journal of the Linnean Society*, 143, 599–616.
- Evans, S.E. & Milner, A.R. (1996) A metamorphosed salamander from the Early Cretaceous of Las Hoyas, Spain. *Philosophical Transactions of the Royal Society, Biological Sciences*, 351, 627–646.
- Evans, S.E., Milner, A.R. & Werner, C. (1996) Sirenid salamanders and a gymnophionan amphibian from the Cretaceous of the Sudan. *Palaeontology*, 39, 77–95.
- Evans, S.E. & Sigogneau-Russell, D. (2001) A stem-group caecilian (Lissamphibia: Gymnophiona) from the Lower Cretaceous of

North Africa. *Paleontology*, 44, 259–273.

- Faivovich, J., Haddad, C.F.B., Baêta, D., Jungfer, K.-H., Álvares, G.F.R., Brandão, R.A., Sheil, C., Barrientos, L.S., Barrio-Amorós, C.L., Cruz, C.A.G. & Wheeler, W.C. (2010) The phylogenetic relationships of the charismatic poster frogs, Phyllomedusinae (Anura, Hylidae). *Cladistics*, 26, 227–261.
- Faivovich, J., Haddad, C.F.B., Garcia, P.C.A., Frost, D.R., Campbell, J.A. & Wheeler, W.C. (2005) Systematic review of the frog family Hylidae, with special reference to Hylinae: phylogenetic analysis and taxonomic revision. *Bulletin of the American Museum of Natural History*, 294, 1–240.
- Farris, J.S., Kluge, A.G. & Mckevich, M.F. (1982) Phylogenetic analysis, the monothetic group method, and myobatrachid frogs. *Systematic Zoology*, 31, 317–327.
- Fei, L. & Ye, C. (2000) A new hynobiid subfamily with a new genus and new species of Hynobiidae from west China (in Chinese with English abstract). *Cultura Herpetologica Sinica Zunyi*, 8, 64–70.
- Ford, L.S. (1990) *The Phylogenetic Position of Poison-dart Frogs (Dendrobatidae): Reassessment of the Neobatrachian Phylogeny with Commentary on Complex Character Systems*. Unpublished Ph.D. Thesis, University of Kansas, Lawrence, Kansas, 307 pp.
- Ford, L.S. & Cannatella, D.C. (1993) The major clades of frogs. *Herpetological Monographs*, 7, 94–117.
- Frost, D.R. (Ed.) (1985) *Amphibian Species of the World. A Taxonomic and Geographical Reference*. Allen Press and Association of Systematics Collections, Lawrence, Kansas, 732 pp.
- Frost, D.R. (2011) *Amphibian Species of the World: an Online Reference. Version 5.5*. Accessible at <http://research.amnh.org/vz/herpetology/amphibia>
- Frost, D.R., Grant, T., Faivovich, J., Bain, R.H., Haas, A., Haddad, C.F.B., de Sá, R.O., Channing, A., Wilkinson, M., Donnellan, S.C., Raxworthy, C.J., Campbell, J.A., Blotto, B.L., Moler, P., Drewes, R.C., Nussbaum, R.A., Lynch, J.D., Green, D.M. & Wheeler, W.C. (2006) The amphibian tree of life. *Bulletin of the American Museum of Natural History*, 297, 1–370.
- Gao, K.-Q. & Chen, S. (2004) A new frog (Amphibia: Anura) from the Lower Cretaceous of western Liaoning, China. *Cretaceous Research*, 25, 761–769.
- Gao, K.-Q. & Wang, Y. (2001) Mesozoic anurans from Liaoning Province, China, and phylogenetic relationships of archaebatrachian anuran clades. *Journal of Vertebrate Paleontology*, 21, 460–476.
- Gardner, J.D. (2003) The fossil salamander *Proamphiuma cretacea* Estes (Caudata; Amphiumidae) and relationships within the Amphiumidae. *Journal of Vertebrate Paleontology*, 23, 769–782.
- Gissi, C., San Mauro, D., Pesole, G. & Zardoya, R. (2006) Mitochondrial phylogeny of Anura (Amphibia): a case study of congruent phylogenetic reconstruction using amino acid and nucleotide characters. *Gene*, 366, 228–237.
- Glaw, F., Hoegg, S. & Vences, M. (2006) Discovery of a new basal relict lineage of Madagascan frogs and its implications for mantellid evolution. *Zootaxa*, 1334, 27–43.
- Glaw, F. & Vences, M. (2006) Phylogeny and genus-level classification of mantellid frogs (Amphibia, Anura). *Organisms, Diversity & Evolution*, 6, 236–243.
- Gower, D.J., Giri, V., Dharne, M.S. & Shouche, Y.S. (2008) Frequency of independent origins of viviparity among caecilians (Gymnophiona): evidence from the first ‘live-bearing’ Asian amphibian. *Journal of Evolutionary Biology*, 21, 1220–1226.
- Gower, D.J., Kupfer, A., Oommen, O.V., Himstedt, W., Nussbaum, R.A., Loader, S.P., Presswell, B., Müller, H., Krishna, S.B., Boistel, R. & Wilkinson, M. (2002) A molecular phylogeny of ichthyophiid caecilians (Amphibia: Gymnophiona: Ichthyophiidae): out of India or out of south east Asia? *Proceedings of the Royal Society of London B*, 269, 1563–1569.
- Gower, D.J. & Wilkinson, M. (2009) Caecilians (Gymnophiona). In: Hedges, S.B. & Kumar, S. (Eds.), *The Timetree of Life*. Oxford University Press, New York, pp. 369–372.
- Grant, T., Frost, D.R., Caldwell, J.P., Gagliardo, R., Haddad, C.F.B., Kok, P.J.R., Means, D.B., Noonan, B.P., Schargel, W.E. & Wheeler, W.C. (2006) Phylogenetic systematics of dart-poison frogs and their relatives (Amphibia: Athesphatanura: Dendrobatidae). *Bulletin of the American Museum of Natural History*, 299, 1–262.
- Green, D.M., Sharbel, T.F., Hitchmough, R.A. & Daugherty, C.H. (1989) Genetic variation in the genus *Leiopelma* and relationships to other primitive frogs. *Zeitschrift für Zoologische Systematik und Evolutionsforschung*, 27, 65–79.
- Guayasamin, J.M., Castroviejo-Fisher, S., Ayarzagüena, J., Trueb, L. & Vilà, C. (2008) Phylogenetic relationships of glassfrogs (Centrolenidae) based on mitochondrial and nuclear genes. *Molecular Phylogenetics and Evolution*, 48, 574–595.
- Guayasamin, J.M., Castroviejo-Fisher, S., Trueb, L., Ayarzagüena, J., Rada, M. & Vilà, C. (2009) Phylogenetic systematics of glassfrogs (Amphibia: Centrolenidae) and their sister taxon *Allophryne ruthveni*. *Zootaxa*, 2100, 1–97.
- Gubin, Y.M. (1991) Paleocene salamanders from southern Mongolia. *Paleontological Journal*, 25, 91–102.
- Haas, A. (2003) Phylogeny of frogs inferred from primarily larval characters (Amphibia: Anura). *Cladistics*, 19, 23–89.
- Hay, J.M., Ruvinsky, I., Hedges, S.B. & Maxson, L.R. (1995) Phylogenetic relationships of amphibian families inferred from DNA sequences of mitochondrial 12S and 16S ribosomal RNA genes. *Molecular Biology and Evolution*, 12, 928–937.
- Hedges, S.B., Duellman, W.E. & Heinicke, M.P. (2008) New World direct-developing frogs (Anura: Terrarana): molecular phylogeny, classification, biogeography, and conservation. *Zootaxa*, 1737, 1–182.
- Hedges, S.B. & Maxson, L.R. (1993) A molecular perspective on lissamphibian phylogeny. *Herpetological Monographs*, 7, 27–42.
- Hedges, S.B., Nussbaum, R.A. & Maxson, L.R. (1993) Caecilian phylogeny and biogeography inferred from mitochondrial DNA sequences of the 12S rRNA and 16S rRNA genes (Amphibia: Gymnophiona). *Herpetological Monographs*, 7, 64–76.
- Heinicke, M.P., Duellman, W.E. & Hedges, S.B. (2007) Major Caribbean and Central American frog faunas originated by ancient oceanic dispersal. *Proceedings of the National Academy of Sciences USA*, 104, 10092–10097.
- Heinicke, M.P., Duellman, W.E., Trueb, L., Means, D.B., MacCulloch, R.D. & Hedges, S.B. (2009) A new frog family (Anura: Terrarana) from South America and an expanded direct-developing clade revealed by molecular phylogeny. *Zootaxa*, 2211, 1–35.
- Henrici, A.C. (1994) *Tephrodytes brassicarvalis*, new genus and species (Anura: Pelodytidae), from the Arikarean Cabbage Patch beds of Montana, USA, and pelodytid–pelobatid relationships. *Annals of Carnegie Museum*, 63, 155–183.

- Henrici, A.C. (1998) A new pipoid anuran from the Late Jurassic Morrison Formation at Dinosaur National Monument, Utah. *Journal of Vertebrate Paleontology*, 18, 321–332.
- Henrici, A.C. (2009) Reassessment of *Scaphiopus neuter* Kluge, 1966 (Anura: Pelobatoidea: Pelobatidae), based on new material from Anceney, Montana (Early Barstovian). *Annals of Carnegie Museum*, 78, 273–287.
- Henrici, A.C. & Haynes, S.R. (2006) *Elkobatrachus brocki*, a new pelobatid (Amphibia: Anura) from the Eocene Elko Formation of Nevada. *Annals of Carnegie Museum*, 75, 11–35.
- Heyer, W.R. (1998) The relationships of *Leptodactylus diedrus* (Anura, Leptodactylidae). *Alytes*, 16, 1–24.
- Heyer, W.R. & Liem, D.S. (1976) Analysis of the intergeneric relationships of the Australian frog family Myobatrachidae. *Smithsonian Contributions to Zoology*, 233, 1–29.
- Hillis, D.M. & Wilcox, T.P. (2005) Phylogeny of the New World true frogs (*Rana*). *Molecular Phylogenetics and Evolution*, 34, 299–314.
- Hiobiarilanto, T.R., Randrianiana, R.-D., Glos, J., Strauß, A. & Vences, M. (2010) Description of ten tadpoles in the genus *Boophis* from Madagascar. *Zootaxa*, 2694, 1–25.
- Hoegg, S., Vences, M., Brinkmann, H. & Meyer, A. (2004) Phylogeny and comparative substitution rates of frogs inferred from sequences of three nuclear genes. *Molecular Biology and Evolution*, 21, 1188–1200.
- Irisarri, I., San Mauro, D., Green, D.M. & Zardoya, R. (2010) The complete mitochondrial genome of the relict frog *Leiopelma archeyi*: insights into the root of the frog Tree of Life. *Mitochondrial DNA*, 21, 173–182.
- Irisarri, I., Vences, M., San Mauro, D., Glaw, F. & Zardoya, R. (2011) Reversal to air-driven sound production revealed by a molecular phylogeny of tongueless frogs, family Pipidae. *BMC Evolutionary Biology*, 11, 114.
- Ivachnenko, M.F. (1978) Urodela from the Triassic and Jurassic of Soviet Central Asia. *Paleontologicheskii Zhurnal*, 3, 84–89.
- Jenkins, F.A., Jr. & Walsh, D.M. (1993) An Early Jurassic caecilian with limbs. *Nature*, 365, 246–250.
- Jenkins, F.A., Jr., Walsh, D.M. & Carroll, R.L. (2007) Anatomy of *Eocaecilia micropodia*, a limbed caecilian of the Early Jurassic. *Bulletin of the Museum of Comparative Zoology*, 158, 285–366.
- Jiang, J., Dubois, A., Ohler, A., Tillier, A., Chen, X., Xie, F. & Stöck, M. (2005) Phylogenetic relationships of the tribe Paini (Amphibia, Anura, Ranidae) based on partial sequences of mitochondrial 12s and 16s rRNA genes. *Zoological Science*, 22, 353–352.
- Kokobum, M.N. de C. & Giaretta, A.A. (2005) Reproductive ecology and behavior of a species of *Adenomera* (Anura, Leptodactylinae) with endotrophic tadpoles: systematic implications. *Journal of Natural History*, 39, 1745–1758.
- Kosuch, J., Vences, M., Dubois, A., Ohler, A. & Böhme, W. (2001) Out of Asia: mitochondrial DNA evidence for an Oriental origin of tiger frogs, genus *Hoplobatrachus*. *Molecular Phylogenetic and Evolution*, 21, 398–407.
- Kurabayashi, A., Kuramoto, M., Joshy, H. & Sumida, M. (2005) Molecular phylogeny of the ranid frogs from southwest India based on mitochondrial ribosomal RNA gene sequences. *Zoological Science*, 22, 525–534.
- Kurabayashi, A., Sumida, M., Yonekawa, H., Glaw, F., Vences, M. & Hasegawa, M. (2008) Phylogeny, recombination, and mechanisms of stepwise mitochondrial genome reorganization in mantellid frogs from Madagascar. *Molecular Biology and Evolution*, 25, 874–891.
- Kurabayashi, A., Yoshikawa, N., Sato, N., Hayashi, Y., Oumi, S., Fujii, T. & Sumida, M. (2010) Complete mitochondrial DNA sequence of the endangered frog *Odorrana ishikawae* (family Ranidae) and unexpected diversity of mt gene arrangements in ranids. *Molecular Phylogenetics and Evolution*, 56, 543–553.
- Kurabayashi, A., Matsui, M., Belabut, D.M., Yong, H.-S., Ahmad, N., Sudin, A., Kuramoto, M., Hamidy, A. & Sumida, M. (2011) From Antarctica to Asia? New colonization scenario for Australian-New Guinean narrow mouth toads suggested from the findings on a mysterious genus *Gastrophrynoides*. *BMC Evolutionary Biology*, 11, 175.
- La Marca, E. (2007) Sinopsis taxonómica de dos géneros nuevos de anfibios (Anura: Leptodactylidae) de los Andes de Venezuela. *Herpetotropicos*, 3, 67–87.
- Larsen, J.H., Jr. (1963) *The Cranial Osteology of Neotenic and Transformed Salamanders and its Bearing on Interfamilial Relationships*. Unpublished Ph.D. thesis, University of Washington, Seattle, 214 pp.
- Larsen, J.H., Jr. & Guthrie, D.J. (1974) Parallelism in the Proteidae reconsidered. *Copeia*, 1974, 635–643.
- Larson, A. & Dimmick, W.W. (1993) Phylogenetic relationships of the salamander families: an analysis of congruence among morphological and molecular characters. *Herpetological Monographs*, 7, 77–93.
- Lathrop, A. (1997) Taxonomic review of the megophryid frogs (Anura: Pelobatoidea). *Asiatic Herpetological Research*, 7, 68–79.
- Laurent, R.F. (1941) Contribution à l'ostéologie et à la systématique des Rhacophoridae africains. Première Note. *Revue de Zoologie et de Botanique Africaines*, 35, 85–111.
- Laurent, R.F. (1942) Note sur l'ostéologie de *Trichobatrachus robustus*. *Revue de Zoologie et de Botanique Africaines*, 36, 56–60.
- Laurent, R.F. (1951) Sur la nécessité de supprimer la famille des Rhacophoridae mais de créer celle des Hyperoliidae. *Revue de Zoologie et de Botanique Africaines*, 45, 116–122.
- Laurent, R.F. (1986) The systematic position of the genus *Afraxalus* Laurent (Hyperoliidae). *Alytes*, 5, 1–6.
- Laurin, M. & Reisz, R.R. (1997) A new perspective on tetrapod phylogeny. In: Sumida, S. & Martin, K.L.M. (Eds.), *Amniote Origins*. Academic Press, San Diego, pp. 5–59.
- Li, J.-T., Che, J., Murphy, R.W., Zhao, H., Zhao, E.-M., Rao, D.-Q. & Zhang, Y.-P. (2009) New insights to the molecular phylogenetics and generic assessment in the Rhacophoridae (Amphibia: Anura) based on five nuclear and three mitochondrial genes, with comments on the evolution of reproduction. *Molecular Phylogenetics and Evolution*, 53, 509–522.
- Lynch, J.D. (1971) Evolutionary relationships, osteology, and zoogeography of leptodactylid frogs. *University of Kansas Museum of Natural History, Miscellaneous Publications*, 53, 1–238.
- Lynch, J.D. (1973) The transition from archaic to advanced frogs. In: Vial, J.L. (Ed.), *Evolutionary Biology of the Anurans: Contemporary Research on Major Problems*. University of Missouri Press, Columbia, pp. 133–182.

- Maciel, N.D., Collevatti, R.G., Colli, G.R. & Schwartz, E.F. (2010) Late Miocene diversification and phylogenetic relationships of the huge toads in the *Rhinella marina* (Linnaeus, 1758) species group (Anura: Bufonidae). *Molecular Phylogenetics and Evolution*, 57, 787–797.
- Manzanilla, J., La Marca, E. & García-París, M. (2009) Phylogenetic patterns of diversification in a clade of Neotropical frogs (Anura: Aromobatidae: *Mannophryne*). *Biological Journal of the Linnean Society*, 97, 185–199.
- Marjanović, D. & Laurin, M. (2007) Fossils, molecules, divergence times, and the origin of lissamphibians. *Systematic Biology*, 56, 369–388.
- Marjanović, D. & Laurin, M. (2008). A reevaluation of the evidence supporting an unorthodox hypothesis on the origin of extant amphibians. *Contributions to Zoology*, 77, 149–199.
- Marjanović, D. & Laurin, M. (2009) The origin(s) of modern amphibians: a commentary. *Evolutionary Biology*, 36, 336–338.
- Meegaskumbura, M., Meegaskumbura, S., Bowatte, G., Manamendra-Arachchi, K., Pethiyagoda, R., Hanken, J. & Schneider, C.J. (2010) *Taruga* (Anura: Rhacophoridae), a new genus of foam-nesting tree frogs endemic to Sri Lanka. *Ceylon Journal of Science*, 39, 75–94.
- Milner, A.R. (2000) Mesozoic and Tertiary Caudata and Albanerpetontidae. In: Heatwole, H. & Carroll, R.L. (Eds.), *Amphibian Biology. Volume 4. Palaeontology*, Surrey Beatty & Sons, Chipping Norton, pp. 1412–1444.
- Morgan, M.J., Roberts, J.D. & Keogh, J.S. (2007) Molecular phylogenetic dating supports an ancient endemic speciation model in Australia's biodiversity hotspot. *Molecular Phylogenetics and Evolution*, 44, 371–385.
- Mueller, R.L., Macey, J.R., Jaekel, M., Wake, D.B. & Boore, J.L. (2004) Morphological homoplasy, life history evolution, and historical biogeography of plethodontid salamanders inferred from complete mitochondrial genomes. *Proceedings of the National Academy of Sciences USA*, 101, 13820–13825.
- Nessov, L.A. (1988) Late Mesozoic amphibians and lizards of Soviet Middle Asia. *Acta Zoologica Cracovia*, 31, 475–486.
- Noble, G.K. (1925) An outline of the relation of ontogeny to phylogeny within the Amphibia. *American Museum Novitates*, 165, 1–18.
- Nuin, P.A.S. & do Val, F.C. (2005) Phylogenetic analysis of the subfamily Hylodinae (Anura, Leptodactylidae) based on morphological characters. *Amphibia-Reptilia*, 26, 139–147.
- Nussbaum, R.A. (1982) Heterotopic bones in the hindlimbs of frogs in the families Pipidae, Ranidae, and Sooglossidae. *Herpetologica*, 38, 312–320.
- Nussbaum, R.A. (1985) Systematics of caecilians (Amphibia: Gymnophiona) of the family Scolecomorphidae. *Occasional Papers of the Museum of Zoology, University of Michigan*, 713, 1–49.
- Nussbaum, R.A., Jaslow, A. & Watson, J. (1982) Vocalization in frogs of the family Sooglossidae. *Journal of Herpetology*, 16, 198–204.
- Nussbaum, R.A. & Wilkinson, M. (1989) On the classification and phylogeny of caecilians (Amphibia: Gymnophiona), a critical review. *Herpetological Monographs*, 3, 1–42.
- Nussbaum, R.A. & Wu, S.-H. (2007) Morphological assessments and phylogenetic relationships of the Seychellean frogs of the family Sooglossidae (Amphibia: Anura). *Zoological Studies*, 46, 322–335.
- Padial, J.M., Castroviejo-Fisher, S. & De la Riva, I. (2009) The phylogenetic relationships of *Yunganastes* revisited (Anura: Terrarana). *Molecular Phylogenetics and Evolution*, 52, 911–915.
- Parsons, T.S. & Williams, E.E. (1963) The relationships of the modern Amphibia: a re-examination. *Quarterly Review of Biology*, 38, 26–53.
- Pauly, G.B., Hillis, D.M. & Cannatella, D.C. (2009) Taxonomic freedom and the role of official lists of species names. *Herpetologica*, 65, 115–128.
- Peabody, F. E. (1954) Trackways of an ambystomid salamander from the Paleocene of Montana. *Journal of Paleontology*, 28, 79–83.
- Peng R., Zhang, P., Xiong, J.-L., Gu, H.-J., Zeng, X.-M. & Zou, F.-D. (2010) Rediscovery of *Protyphlobates puxiongensis* (Caudata: Hynobiidae) and its phylogenetic position based on complete mitochondrial genomes. *Molecular Phylogenetics and Evolution*, 56, 252–258.
- Perez-Peña, P.E., Chavez, G., Twomey, E. & Brown, J.L. (2010) Two new species of *Ranitomeya* (Anura: Dendrobatidae) from eastern Amazonian Peru. *Zootaxa*, 2439, 1–23.
- Ponssa, M.L. & Heyer, W.R. (2007) Osteological characterization of four putative species of the genus *Adenomera* (Anura: Leptodactylidae), with comments on intra- and interspecific variation. *Zootaxa*, 1403, 37–54.
- Ponssa, M.L., Jowers, M.J. & de Sá, R.O. (2010) Osteology, natural history notes, and phylogenetic relationships of the poorly known Caribbean frog *Leptodactylus nesiotus* (Anura, Leptodactylidae). *Zootaxa*, 2646, 1–25.
- Pramuk, J.B., Robertson, T., Sites, Jr., J.W. & Noonan, B.P. (2007) Around the world in 10 million years: biogeography of the nearly cosmopolitan true toads (Anura: Bufonidae). *Global Ecology and Biogeography*, 2007, 1–12.
- Pugener, L.A., Maglia, A.M. & Trueb, L. (2003) Revisiting the contribution of larval characters to an analysis of phylogenetic relationships of basal anurans. *Zoological Journal of the Linnean Society*, 139, 129–155.
- Pyron, R.A. & Wiens, J.J. (2011) A large-scale phylogeny of Amphibia including over 2,800 species, and a revised classification of extant frogs, salamanders, and caecilians. *Molecular Phylogenetics and Evolution*, 61, 543–583.
- Rabanal, F.E. & Formas, J.R. (2009) Complementary diagnosis of the genus *Insuetophrynus* (Anura, Cyclorhampidae) based on larval characters. *Zootaxa*, 2116, 59–67.
- Rao, D.-Q. & Wilkinson, J.A. (2008) Phylogenetic relationships of the mustache toads inferred from mtDNA sequences. *Molecular Phylogenetics and Evolution*, 46, 61–73.
- Read, K., Keogh, J.S., Scott, I.A.W., Roberts, J.D. & Doughty, P. (2001) Molecular phylogeny of the Australian frog genera *Crinia*, *Geocrinia*, and allied taxa (Anura: Myobatrachidae). *Molecular Phylogenetics and Evolution*, 21, 294–308.
- Rieppel, O. & Grande, L. (1998) A well-preserved fossil amphiumid (Lissamphibia: Caudata) from the Eocene Green River Formation of Wyoming. *Journal of Vertebrate Paleontology*, 18, 700–708.

- Roberts, J.L., Brown, J.L., von May, R., Arizabal, W., Presar, A., Symula, R., Schulte, R. & Summers, K. (2006) Phylogenetic relationships among poison frogs of the genus *Dendrobates* (Dendrobatidae): a molecular perspective from increased taxon sampling. *Herpetological Journal*, 16, 377–385.
- Roček, Z. (2003) Larval development in Oligocene palaeobatrachid frogs. *Acta Palaeontologica Polonica*, 48, 595–607.
- Roček, Z. (2008) The Late Cretaceous frog *Gobiates* from Central Asia: its evolutionary status and possible phylogenetic relationships. *Cretaceous Research*, 29, 577–591.
- Roelants, K. & Bossuyt, F. (2005) Archaeobatrachian paraphyly and Pangaeian diversification of crown-group frogs. *Systematic Biology*, 54, 111–126.
- Roelants, K., Jiang, J. & Bossuyt, F. (2004) Endemic ranid (Amphibia: Anura) genera in southern mountain ranges of the Indian subcontinent represent ancient frog lineages: evidence from molecular data. *Molecular Phylogenetics and Evolution*, 31, 730–740.
- Roelants, K., Gower, D.J., Wilkinson, M., Loader, S.P., Biju, S.D., Guillaume, K., Moriau, L. & Bossuyt, F. (2007) Global patterns of diversification in the history of modern amphibians. *Proceedings of the National Academy of Sciences USA*, 104, 887–892.
- Rogers, K. (1976) Herpetofauna of the Beck Ranch Local Fauna (Upper Pliocene: Blancan) of Texas. *Publications of the Museum, Michigan State University, Paleontological Series*, 1, 163–200.
- Romer, A. S. (1966) *Vertebrate Paleontology*. Third Edition. University of Chicago Press, Chicago, 468 pp.
- Rosauer, D., Laffan, S.W., Crisp, M.D., Donnellan, S.C. & Cook, L.G. (2009) Phylogenetic endemism: a new approach for identifying geographical concentrations of evolutionary history. *Molecular Ecology*, 18, 4061–4072.
- Ruane, S., Pyron, R.A. & Burbrink, F.T. (2011) Phylogenetic relationships of the Cretaceous frog *Beelzebufo* from Madagascar and the placement of fossil constraints based on temporal and phylogenetic evidence. *Journal of Evolutionary Biology*, 24, 274–285.
- Ruta, M., Jeffery, J.E. & Coates, M.I. (2003) A supertree of early tetrapods. *Proceedings of the Royal Society of London B*, 270, 2507–2516.
- Ruvinsky, I. & Maxson, L.R. (1996) Phylogenetic relationships among bufonoid frogs (Anura: Neobatrachia) inferred from mitochondrial DNA sequences. *Molecular Phylogenetics and Evolution*, 5, 533–547.
- San Mauro, D. (2010) A multilocus timescale for the origin of extant amphibians. *Molecular Phylogenetics and Evolution*, 56, 554–561.
- San Mauro, D., García-París, M. & Zardoya, R. (2004a) Phylogenetic relationships of discoglossid frogs (Amphibia: Anura: Discoglossidae) based on complete mitochondrial genomes and nuclear genes. *Gene*, 343, 357–366.
- San Mauro, D., Gower, D.J., Massingham, T., Wilkinson, M., Zardoya, R. & Cotton, J.A. (2009) Experimental design in caecilian systematics: phylogenetic information of mitochondrial genomes and nuclear *rag1*. *Systematic Biology*, 58, 425–438.
- San Mauro, D., Gower, D.J., Oommen, O.V., Wilkinson, M. & Zardoya, R. (2004b) Phylogeny of caecilian amphibians (Gymnophiona) based on complete mitochondrial genomes and nuclear RAG1. *Molecular Phylogenetics and Evolution*, 33, 413–427.
- San Mauro, D., Vences, M., Alcobendas, M., Zardoya, R. & Meyer, A. (2005) Initial diversification of living amphibians predated the breakup of Pangaea. *American Naturalist*, 165, 590–599.
- Sánchez, B. (1998) Part 4. *Salientia. Handbuch der Paläoherpetologie*. P. Wellnhofer (Ed.). Fischer Verlag, Stuttgart, 275 pp.
- Santos, J.C. & Cannatella, D.C. (2011) Phenotypic integration emerges from aposematism and scale in poison frogs. *Proceedings of the National Academy of Sciences USA*, 108, 6175–6180.
- Santos, J.C., Coloma, L.A., Summers, K., Caldwell, J.P., Ree, R. & Cannatella, D.C. (2009) Amazonian amphibian diversity is primarily derived from Late Miocene Andean lineages. *PLoS Biology*, 7, e1000056.
- Scott, E. (2005) A phylogeny of ranid frogs (Anura: Ranoidea: Ranidae), based on a simultaneous analysis of morphological and molecular data. *Cladistics*, 21, 507–574.
- Sigurdson, T. & Green, D.M. (2001) The origin of modern amphibians: a re-evaluation. *Zoological Journal of the Linnean Society*, 162, 457–462.
- Skutschas, P.P. (2009) Re-evaluation of *Mynbulakia* (Lissamphibia: Caudata) and description of a new salamander genus from the Late Cretaceous of Uzbekistan. *Journal of Vertebrate Paleontology*, 29, 659–664.
- Skutschas, P.P. & Gubin, Y.M. (In press) A new salamander from the late Paleocene–early Eocene of Ukraine. *Acta Palaeontologica Polonica*, DOI:10.4202/app.2010.0101
- Skutschas, P. & Martin, T. (2011) Cranial anatomy of the stem salamander *Kokartus honorarius* (Amphibia: Caudata) from the Middle Jurassic of Kyrgyzstan. *Zoological Journal of the Linnean Society*, 161, 816–838.
- Stuart, B.L. (2008) The phylogenetic problem of *Huia* (Amphibia: Ranidae). *Molecular Phylogenetics and Evolution*, 46, 49–60.
- Sweetman, S.C. & Gardner, J.D. (In press) A new albanerpetontid amphibian from the Early Cretaceous (Barremian) Wessex Formation of the Isle of Wight, southern England. *Acta Palaeontologica Polonica*, DOI:10.4202/app.2011.0109
- Taylor, E.H. (1941) A new anuran from the middle Miocene of Nevada. *University of Kansas Science Bulletin*, 27, 61–69.
- Trueb, L. & Báez, A. (2006) Revision of the Early Cretaceous *Cordicephalus* from Israel and an assessment of its relationships among pipoid frogs. *Journal of Vertebrate Paleontology*, 26, 44–59.
- Trueb, L. & Cloutier, R. (1991a) Toward an understanding of the amphibians: two centuries of systematic history. In: Schultze, H.-P. & Trueb, L. (Eds.), *Origins of the Higher Groups of Tetrapods: Controversy and Consensus*. Cornell University Press, Ithaca, pp. 175–193.
- Trueb, L. & Cloutier, R. (1991b) A phylogenetic investigation of the inter- and intrarelationships of the Lissamphibia (Amphibia: Temnospondyli). In: Schultze, H.-P. & Trueb, L. (Eds.), *Origins of the Higher Groups of Tetrapods: Controversy and Consensus*. Cornell University Press, Ithaca, pp. 223–313.
- Trueb, L., Diaz, R. & Blackburn, D.C. (In press) Osteology and chondrocranial morphology of *Gastrophryne carolinensis* (Anura: Microhylidae), with a review of the osteological diversity of New World microhylids. *Phyllomedusa*.
- Trueb, L., Ross, C.F. & Smith, R. (2005) A new pipoid anuran from the Late Cretaceous of South Africa. *Journal of Vertebrate Paleontology*, 25, 533–547.

- Twomey, E. & Brown, J.L. (2008) Spotted poison frogs: rediscovery of a lost species and a new genus (Anura: Dendrobatidae) from northwestern Peru. *Herpetologica*, 64, 121–137.
- Twomey, E. & Brown, J.L. (2009) Another new species of *Ranitomeya* (Anura: Dendrobatidae) from Amazonian Columbia. *Zootaxa*, 2302, 48–60.
- Van Bocxlaer, I., Biju, S.D., Loader, S.P. & Bossuyt, F. (2009) Toad radiation reveals into-India dispersal as a source of endemism in the Western Ghats-Sri Lanka biodiversity hotspot. *BMC Evolutionary Biology*, 9, 131.
- Van Bocxlaer, I., Loader, S.P., Roelants, K., Biju, S.D., Menegon, M. & Bossuyt, F. (2010) Gradual adaptation toward a range-expansion phenotype initiated the global radiation of toads. *Science*, 327, 679–682.
- Van Bocxlaer, I., Roelants, K., Biju, S.D., Nagaraju, J. & Bossuyt, F. (2006) Late Cretaceous vicariance in Gondwanan amphibians. *PLoS ONE*, 1, e74.
- van der Meijden, A., Boistel, R., Gerlach, J., Ohler, A., Vences, M. & Meyer, A. (2007a) Molecular phylogenetic evidence for paraphyly of the genus *Sooglossus*, with the description of a new genus of Seychellean frogs. *Biological Journal of the Linnean Society*, 91, 347–359.
- van der Meijden, A., Crottini, A., Tarrant, J., Turner, A. & Vences, M. (2011) Multi-locus phylogeny and evolution of reproductive modes in the Pyxicephalidae, an African endemic clade of frogs. *African Journal of Herpetology*, 60, 1–12.
- van der Meijden, Vences, M., Hoegg, S., Boistel, R., Channing, A. & Meyer, A. (2007b) Nuclear gene phylogeny of narrow-mouthed toads (Family: Microhylidae) and a discussion of competing hypotheses concerning their biogeographical origins. *Molecular Phylogenetics and Evolution*, 44, 1017–1030.
- van der Meijden, A., Vences, M., Hoegg, S. & Meyer, A. (2005) A previously unrecognized radiation of ranid frogs in Southern Africa revealed by nuclear and mitochondrial DNA sequences. *Molecular Phylogenetics and Evolution*, 37, 674–685.
- van der Meijden, A., Vences, M. & Meyer, A. (2004) Novel phylogenetic relationships of the enigmatic brevicipitine and scaphiophrynine toads as revealed by sequences from the nuclear *Rag-1* gene. *Proceedings of the Royal Society of London, B*, 271, S378–S381.
- van Dijk, D.E. (2008) Clades in heleophrynid Salientia. *African Journal of Herpetology*, 57, 43–48.
- Veith, M., Fromhage, L., Kosuch, J. & Vences, M. (2006) Historical biogeography of Western Palearctic pelobatid and pelodytid frogs: a molecular phylogenetic perspective. *Contributions to Zoology*, 75, 109–120.
- Veith, M., Kosuch, J., Rödel, M.-O., Hillers, A., Schmitz, A., Burger, M. & Lötters, S. (2009) Multiple evolution of sexual dichromatism in African reed frogs. *Molecular Phylogenetics and Evolution*, 51, 388–393.
- Vences, M., Kosuch, J., Lötters, S., Widmer, A., Jungfer, K.-H., Köhler, J. & Veith, M. (2000) Phylogeny and classification of poison frogs (Amphibia: Dendrobatidae), based on mitochondrial 16S and 12S ribosomal RNA gene sequences. *Molecular Phylogenetics and Evolution*, 15, 34–40.
- Vences, M., Kosuch, J., Boistel, R., Haddad, C. F. B., La Marca, E., Lötters, S. & Veith, M. (2003a) Convergent evolution of aposematic coloration in Neotropical poison frogs: a molecular phylogenetic perspective. *Organisms Diversity and Evolution*, 3, 215–226.
- Vences, M., Kosuch, J., Glaw, F., Böhme, W. & Veith, M. (2003b) Molecular phylogeny of hyperoliid treefrogs: biogeographic origin of Malagasy and Seychellean taxa and re-analysis of familial paraphyly. *Journal of Zoological Systematics and Evolutionary Research*, 41, 205–215.
- Vences, M., Vieites, D.R., Glaw, F., Brinkmann, H., Kosuch, J., Veith, M. & Meyer, A. (2003c) Multiple overseas dispersal in amphibians. *Proceedings of the Royal Society B*, 270, 2435–2442.
- Venczel, M. (1999) Land salamanders of the family Hynobiidae from the Neogene and Quaternary of Europe. *Amphibia-Reptilia*, 20, 401–412.
- Venczel, M. (2008) A new salamandrid amphibian from the Middle Miocene of Hungary and its phylogenetic relationships. *Journal of Systematic Palaeontology*, 6, 41–59.
- Verdade, V.K. & Rodrigues, M.T. (2007) Taxonomic review of *Allobates* (Anura, Aromobatidae) from the Atlantic Forest, Brazil. *Journal of Herpetology*, 41, 566–580.
- Vieites, D.R., Zhang, P. & Wake, D.B. (2009) Salamanders (Caudata). In: Hedges, S.B. & Kumar, S. (Eds.), *The Timetree of Life*. Oxford University Press, New York, pp. 365–368.
- Vieites, D.R., M.-S. Min & Wake, D.B. (2007) Rapid diversification and dispersal during periods of global warming by plethodontid salamanders. *Proceedings of the National Academy of Sciences USA*, 104, 19903–19907.
- Vieites, D.R., Nieto-Román, S., Wake, M.H. & Wake, D.B. (2011) A multigenic perspective on phylogenetic relationships in the largest family of salamanders, the Plethodontidae. *Molecular Phylogenetics and Evolution*, 59, 623–635.
- Wake, D.B. & Özeti, N. (1969) Evolutionary relationships in the family Salamandridae. *Copeia*, 1969, 124–137.
- Wake, M.H. (1993) Non-traditional characters in the assessment of caecilian phylogenetic relationships. *Herpetological Monographs*, 7, 42–55.
- Wang, Y. & Evans, S.E. (2006) A new short-bodied salamander from the Upper Jurassic/Lower Cretaceous of China. *Acta Palaeontologica Polonica*, 51, 127–130.
- Wang, Y., Gao, K. & Xu, X. (2001) Early evolution of discoglossid frogs: new evidence from the Mesozoic of China. *Naturwissenschaften*, 87, 417–420.
- Weisrock, D.W., Papenfuss, T.J., Macey, J.R., Litvinchuk, S.N., Polymeni, R., Ugurtas, I.H., Zhao, E.-M., Jowkar, H. & Larson A. (2006) A molecular assessment of phylogenetic relationships and lineage accumulation rates within the family Salamandridae (Amphibia, Caudata). *Molecular Phylogenetics and Evolution*, 41, 368–383.
- Wiens, J.J. (2007) Global patterns of diversification and species richness in amphibians. *American Naturalist*, 170, S86–S106.
- Wiens, J.J., Fetzner, Jr., J.W., Parkinson, C.L. & Reeder, T.W. (2005) Hyliid frog phylogeny and sampling strategies for speciose clades. *Systematic Biology*, 54, 719–748.

- Wiens, J.J., Sukumaran, J., Pyron, R.A. & Brown, R.M. (2009) Evolutionary and biogeographic origins of high tropical diversity in Old World frogs (Ranidae). *Evolution*, 63, 1217–1231.
- Wilkinson, M., Loader, S.P., Gower, D.J., Sheps, J.A. & Cohen, B.L. (2003) Phylogenetic relationships of African caecilians (Amphibia: Gymnophiona): insights from mitochondrial rRNA gene sequences. *African Journal of Herpetology*, 52, 83–92.
- Wilkinson, M. & Nussbaum, R.A. (1996) On the phylogenetic position of the Uraeotyphlidae. *Copeia*, 1996, 550–562.
- Wilkinson, M. & Nussbaum, R.A. (1997) Comparative morphology and evolution of the lungless caecilian *Atretochoana eiselti* (Taylor) (Amphibia: Gymnophiona: Typhlonectidae). *Biological Journal of the Linnean Society*, 62, 39–109.
- Wilkinson, M. & Nussbaum, R.A. (1999) Evolutionary relationships of the lungless caecilian *Atretochoana eiselti* (Amphibia: Gymnophiona: Typhlonectidae). *Zoological Journal of the Linnean Society*, 126, 191–223.
- Wilkinson, M. & Nussbaum, R.A. (2006) Caecilian phylogeny and classification. In: Exbrayat, J.-M. (Ed.), *Reproductive Biology and Phylogeny of Gymnophiona*. Science Publishers, Enfield, pp. 39–78.
- Wilkinson, M., San Mauro, D., Sherratt, E. & Gower, D. J. (2011) A nine-family classification of caecilians (Amphibia: Gymnophiona). *Zootaxa*, 2874, 41–64.
- Yu, G., Rao, D., Zhang, M. & Yang, J. (2009) Re-examination of the phylogeny of Rhacophoridae (Anura) based on mitochondrial and nuclear DNA. *Molecular Phylogenetics and Evolution*, 50, 571–579.
- Zhang, G., Wang, Y., Jones, M.E.H. & Evans, S.E. (2009) A new Early Cretaceous salamander (*Regalerpeton weichangensis* gen. et sp. nov.) from the Huajiyang Formation of northeastern China. *Cretaceous Research*, 30, 551–558.
- Zhang, P., Papenfuss, T.J., Wake, M.H., Qu, L. & Wake, D.B. (2008) Phylogeny and biogeography of the family Salamandridae (Amphibia: Caudata) inferred from complete mitochondrial genomes. *Molecular Phylogenetics and Evolution*, 49, 586–597.
- Zhang, P. & Wake, D.B. (2009a) Higher-level salamander relationships and divergence dates inferred from complete mitochondrial genomes. *Molecular Phylogenetics and Evolution*, 53, 492–508.
- Zhang, P. & Wake, M.H. (2009b) A mitogenomic perspective on the phylogeny and biogeography of living caecilians (Amphibia: Gymnophiona). *Molecular Phylogenetics and Evolution*, 53, 479–491.
- Zheng, Y., Peng, R., Kuro-o, M. & Zeng, X. (2011) Exploring patterns and extent of bias in estimating divergence time from mitochondrial DNA sequence data in a particular lineage: a case study from salamanders (Order Caudata). *Molecular Biology and Evolution*, 28, 2521–2535.
- Zimkus, B.M., Rödel, M.-O. & Hillers, A. (2010) Complex patterns of continental speciation: molecular phylogenetics and biogeography of sub-Saharan puddle frogs (*Phrynobatrachus*). *Molecular Phylogenetics and Evolution*, 55, 883–900.
- Zweifel, R.G. (1956) Two pelobatid frogs from the Tertiary of North America and their relationships to fossil and recent forms. *American Museum Novitates*, 1762, 1–46.

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